WADC TECHNICAL REPORT 52-53

STUDIES TO DETERMINE THE ELECTRICAL AND PHYSICAL PROPERTIES OF AVIATION FUEL

C. C. PETERSEN
ARMOUR RESEARCH FOUNDATION

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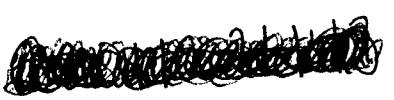
WRIGHT AIR DEVELOPMENT CENTER



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C. C. Petersen
Armour Research Foundation

September 1952

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FOREWORD

This report was prepared by the Armour Research Foundation on Contract Number AF33(038)-3793, Research and Development Order Number 601-301, "Aircraft Fuels and Lubricating Oils". Work was initiated in October, 1950, and was administered under the direction of the Petroleum Products Branch of the Materials Laboratory, Directorate of Research, Wright Air Development Center, with Mr. R. W. Altman acting as Project Engineer. In June, 1951, Mrs. E. J. Bartholomew assumed the duties of Project Engineer. Mr. J. W. Briscoe of the Instrument and Navigation Branch, Equipment Laboratory, Directorate of Laboratories, Wright Air Development Center, also worked closely with this project.

Personnel of the Armour Research Foundation who participated in this project are Harvey J. Finison, Chairman, Electrical Engineering Research, Raymond E. Zenner, Asst. Chairman, Clifford C. Petersen, Supervisor, Professor L. W. Matsch, Joseph L. Radnik, Paul E. Bowers, and George Slad of the Electrical Engineering Department; Maurice Kayner, Research Analytical Chemist, Ralph Hinch Jr., Donald Laskowski, Donald O. Landon, and Ilse M. Wolfson of the Chemistry and Chemical Engineering Department.

ABSTRACT

To assist in evaluating the capacitance type fuel quantity gage for aircraft, a study was made of various fuel specimens by the Armour Research Foundation, Chicago, Illinois, during the period October 1950 to October 1951.

Measurements of dielectric constant, dissipation factor, and density were made on 220 samples of aviation fuels of grades 91/98, 100/130, 115/145, JP-1, JP-3, and JP-4 and certain experimental and foreign fuels received from various suppliers.

This report summarizes this work as well as other investigations such as effect of evaporation, and effect of moisture content.

The capacity index, a criterion of gage response to a given mass of fuel, determined at the reference condition of 32°F and 400 cps, was found to vary as much as 4 or 5% among the specimens of any of the grades 91/98, 115/145, and JP-1, and as much as 5.6% in grades 100/130 and JP-3.

The change in mean values of capacity index due to evaporation of 10% by volume was under .3% for all grades of aviation fuel.

PUBLICATION REVIEW

Manuscript Copy of this report has been reviewed and found satisfactory for publication.

FOR THE COMMANDING GENERAL:

M. E. SORTE
Colonel, USAF
Chief, Materials Laboratory
Directorate of Research

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INTRODUCTION

The capacitance-type fuel quantity gage for aircraft is comprised essentially of a capacitor of concentric cylindrical plates standing vertically in the fuel tank. This arrangement has a certain value of capacitance when the medium between the plates is air. As fuel is added to the tank and the level rises and displaces the air, the value of capacitance increases until, when full, the capacitance is about twice the value measured while empty. The factor two is approximately the dielectric constant of aviation fuels.

In addition to simplifying the sensing element by eliminating moving parts, such as floats which are part of the old type gages, the capacitance-type gage partially compensates for volume changes of the fuel which result from temperature changes. The volumetric expansion of gasoline due to an increase in temperature is accompanied by a decrease in dielectric constant tending partially to maintain a constant value of capacitance for a given mass of fuel, regardless of temperature changes. Further compensation which also corrects for differences between fuels is usually achieved in a simple manner by built in compensators. Since the energy available in a quantity of fuel is dependent on the mass rather than the volume of the fuel, the advantage of this type gage is self evident.

To utilize the capacitance-type fuel quantity gage it is necessary to know the value of dielectric constant for all fuels used. The purpose of this investigation has been to determine the dielectric constant of

various fuel specimens obtained from various sources throughout the United States along with a few fuels from foreign sources, and to investigate the behavior of this electrical characteristic under the influence of changing temperature, and after ten per cent by volume has been evaporated. Density measurements of these specimens were also needed for the purpose of correlation with the dielectric measurements. Dissipation factor measurements were obtained to determine the presence of conductive constituents. A special investigation was also made to determine the effect of moisture.

In addition, work was carried out with a study group composed of representatives of interested users and suppliers of aircraft fuels and fuel gages and a standard test method was developed and proposed.

The investigations reported here were carried out over a period of one year. Measurements were made on a total of 220 specimens of the following types:

Grade 91/98	- 55 specimens
Grade 100/130	- 51 specimens
Grade 115/145	- 44 specimens
Grade JP-1	- 24 specimens
Grade JP-3	- 35 specimens
Grade JP-4	- 6 specimens
Experimental	- 5 specimens.

SECTION I
APPARATUS AND EQUIPMENT

A. Electrical Measuring Equipment

1. Cell

A Balsbaugh type 3TN 25 three terminal liquid dielectric measuring cell was used in the dielectric measurements. It is a guarded cell made of glass and nickel, has an empty capacitance of about 25 micro-microfarads, and holds about 85 cc of liquid. Being small in mass, it is well suited for applications where temperature is to be changed often. This

cell used with the present bridge circuit yields measurements of dielectric constant which are accurate to within ± 1.0 per cent. Sufficient sensitivity is available to distinguish between values of dielectric constant which differ by 0.2 per cent. Figure 1 shows the Balsbaugh cell disassembled.

2. Bridge Circuit

The General Radio Type 716C Capacitance Bridge, used in conjunction with a Wagner ground coupling circuit to balance the guard circuit to ground potential, was selected for these measurements. This bridge is usable up to 300 KC with an accuracy of ± 0.2 micro-microfarads in capacitance and ± 0.0002 or ± 2 per cent, whichever is greater, in dissipation factor. A General Radio Type 722D Precision Condenser was used as a balancing capacitor in the bridge circuit. Figure 2 shows the circuit and Figure 3 is a photograph of the entire bridge circuit.

Equations applicable to the 716C Capacitance Bridge, when used in the substitution method, and when the dissipation factor of the specimen is less than 0.1 are:

$$\text{Capacitance:} \quad C_X = \Delta C$$
$$\text{Dissipation Factor:} \quad D_X = (C'/\Delta C)$$

where

$\Delta C = C' - C$ $\qquad$ f = oscillator frequency
$\Delta D = D - D'$ $\qquad$ f_o = frequency step set on bridge.

Initial readings with the unknown out of the circuit are indicated by primes, and Δ stands for "change in." D and D' include the 0.01 multiplier which should be applied to the scale readings.

With this type of bridge circuit, the generator and detector connections to the bridge should be interchanged at the higher frequencies

to obtain better sensitivity.

3. Oscillator

A Hewlett-Packard Model 200C oscillator having a frequency range of 20 cycles to 200 KC was used as the source. The oscillator gives a voltage of about six volts across the measuring cell at frequencies up to twenty kilocycles. At higher frequencies the voltage decreases to about one volt.

4. Null Detector

As a null detector a General Electric Type CRO-3A Cathode Ray Oscilloscope, with a sensitivity of 0.30 volt per inch, was used in conjunction with an amplifier having a gain of 100.

5. Shielding

Guard shields were used as shown in Figure 2; in addition, grounded exterior shields were used to eliminate 60 cycle pickup. The lining of the temperature chamber was also grounded.

B. Temperature Equipment

1. Chamber

An American Instrument Company, sub-zero, constant temperature test cabinet, using dry ice and providing control accurate within $\pm$ 0.5°F, was used to obtain the required temperatures. Thermostatic equipment operates a blower which forces the cold carbon dioxide atmosphere of the dry ice chamber into the test chamber. Close control of temperature is achieved by heating coils which operate alternately with the cold blower. Chamber temperatures from -100 to +220°F can be maintained.

The measuring cells were suspended in an air bath within the test chamber, as shown in Figure 4. The air bath was constantly circulated by an auxiliary blower.

2. Temperature Measuring Equipment

The temperature was measured by means of a glass stem thermometer placed near the measuring cells and readable through the chamber window. The chamber was held at the desired temperature for 30 minutes before making electrical measurements.

The accuracy of these temperature measurements is considered adequate in view of the small changes of dielectric constant caused by temperature change. An inaccuracy of 3°F will cause a small change in the dielectric constant about equal to the sensitivity of the measuring circuit.

C. Experimental Cell

While the Balsbaugh cell gave adequate results for this investigation, and appeared to be the best of existing cell designs, it was necessary to design a new cell for special investigation, such as moisture content where very small changes in dielectric constant were measured, for the following reasons:

The measurement of dielectric constant and dissipation factor of aviation fuels over a temperature range of -65°F to 130°F imposes a special problem in that existing cells do not provide a closed system for sealing in the vapors and for sealing out condensation. Further characteristics objectionable in existing cells are lack of provision for filling without disturbing the electrodes, too small a capacitance, and difficulty in cleaning if the cell should become contaminated.

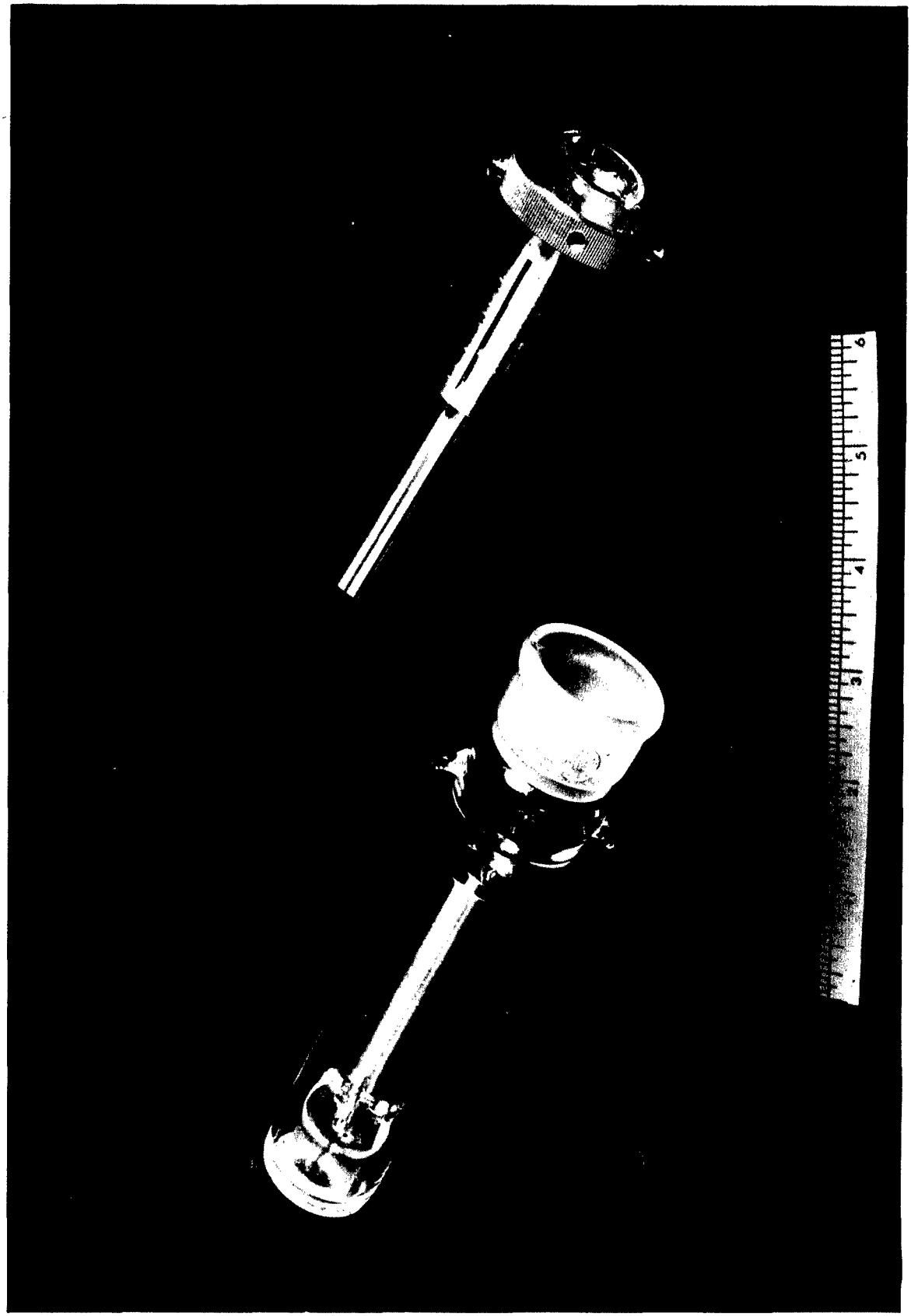
The revised experimental cell, as is shown in Figure 5, is constructed essentially of a standard taper ground joint of Pyrex, two lengths of Pyrex tubing, and two lengths of Nickel tubing. Contacts are carried through the glass by means of platinum wire sealed in the Pyrex and formed into a contact bead. The Nickel tubes slip over these beads by means of grooves in their inner surfaces, and are placed, after slight rotation, so that they wedge tightly over the contact beads. Small wedge shaped grooves in the cylinders insure good contact and fix their positions. All parts can be removed for thorough cleaning.

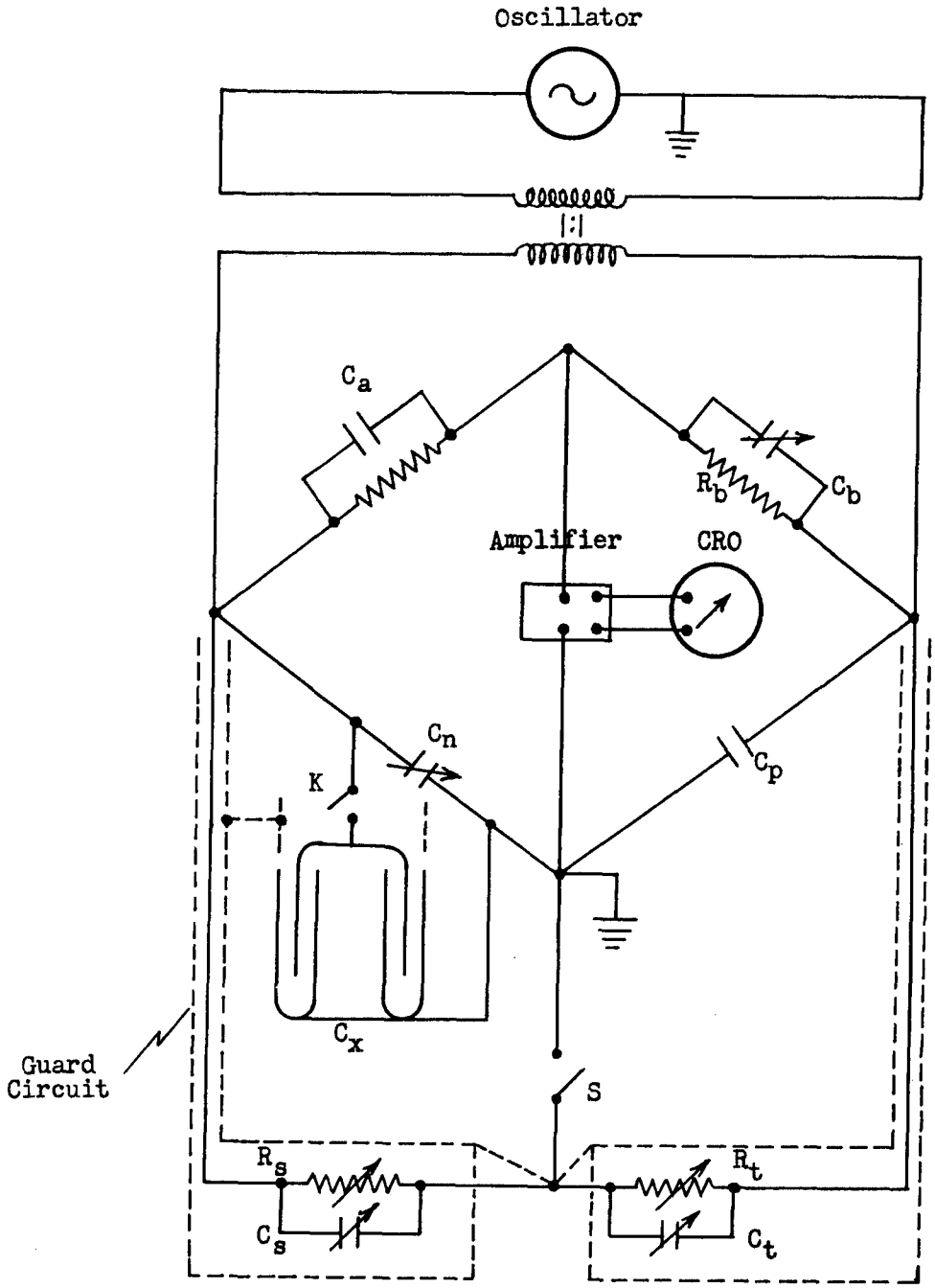
The cell was further equipped with a reservoir and filling and draining cocks to permit filling without disturbing the electrodes and to facilitate testing of successive samples, in which case the cell is flushed with an excess portion of the sample to be tested.

This type of construction results in a high capacitance, low liquid volume cell which presents a large external surface area to the temperature bath in which the cell is placed. Because of its higher capacitance, this cell increases the accuracy of the capacitance measurements and also increases the sensitivity of the dissipation factor measurements.

The revised cell has the following characteristics:

Overall Height in Stand	18 7/8"
Projected Floor Space	8" x 10"
I.D. of Outer Electrode	3-3/64"
O.D. of Inner and Guard Electrodes	2-15/16"
Average Gap	.070"
Length of Electrodes, Outer	6-3/4"
Inner	5"
Guards	1"
Wall Thickness of Electrodes	.030"
Capacitance, Empty	150mmf
Liquid Capacity	175ml





Oscillator	Hewlett-Packard Model 200C
Amplifier	Ballantine Model 220
Cathode Ray Oscilloscope	General Electric, Type CRO-3A
C_p	General Radio Type 722D Precision Condenser with worm correction
R_s and R_t	General Radio Type 602 Decade Resistance Boxes
C_s and C_t	General Radio Type 722D Precision Condensers
R_a, R_b, C_a, C_b, and C_n	General Radio Type 716C Capacitance Bridge

FIG. 2 - BRIDGE CIRCUIT

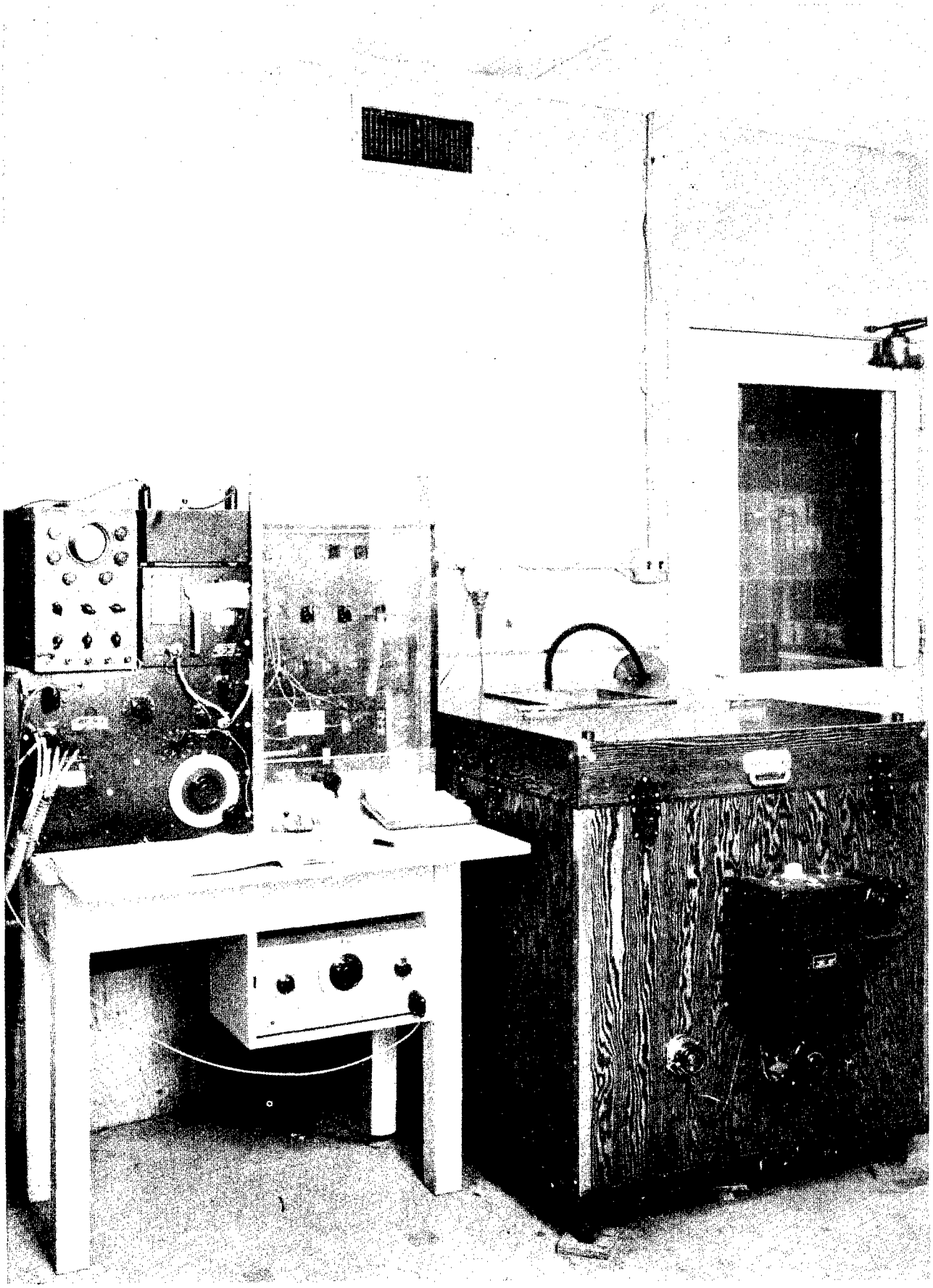


Figure 3. BRIDGE AND INSTRUMENTS

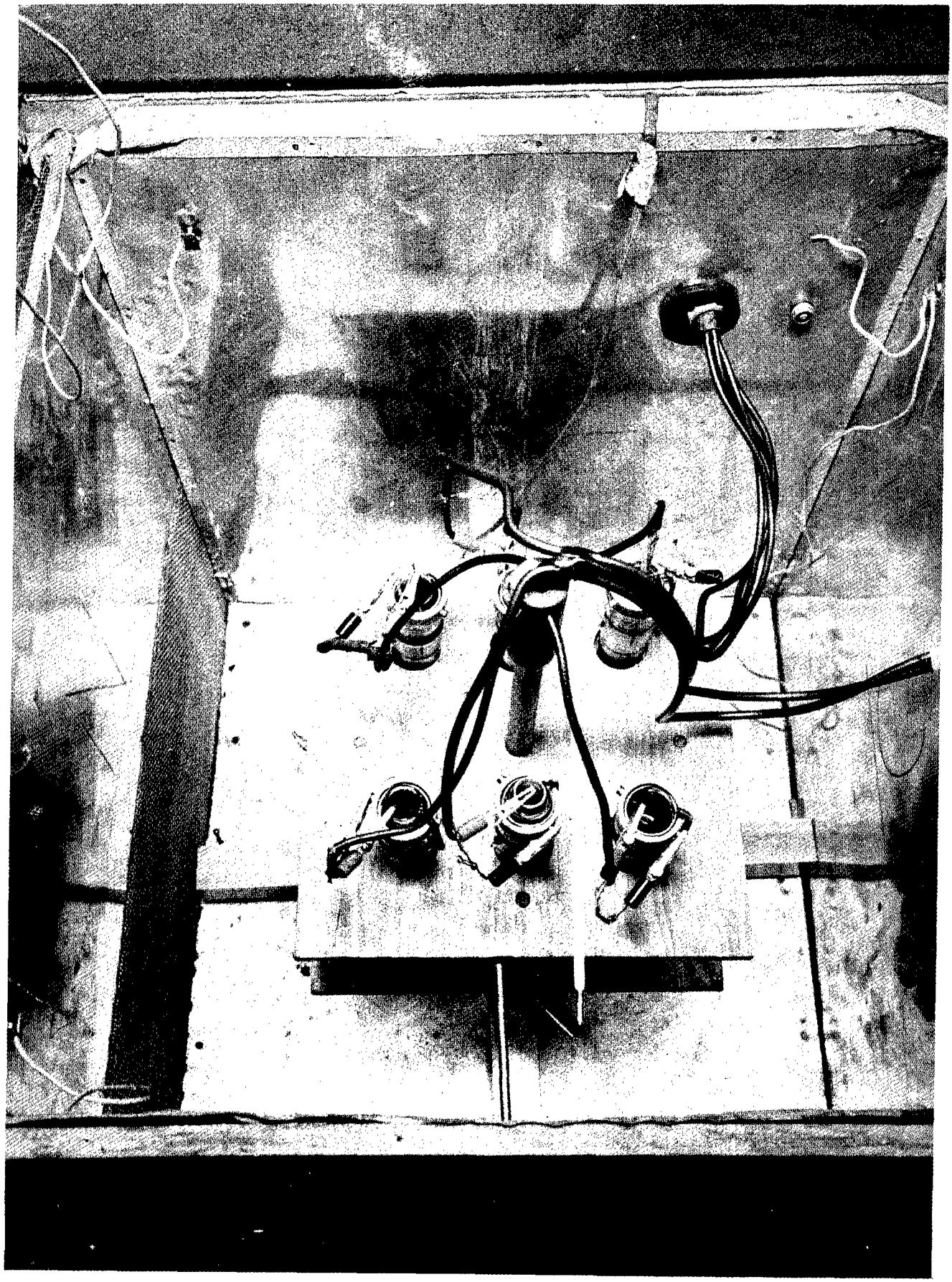


Figure 4. ARRANGEMENT OF CELLS IN TEMPERATURE CABINET

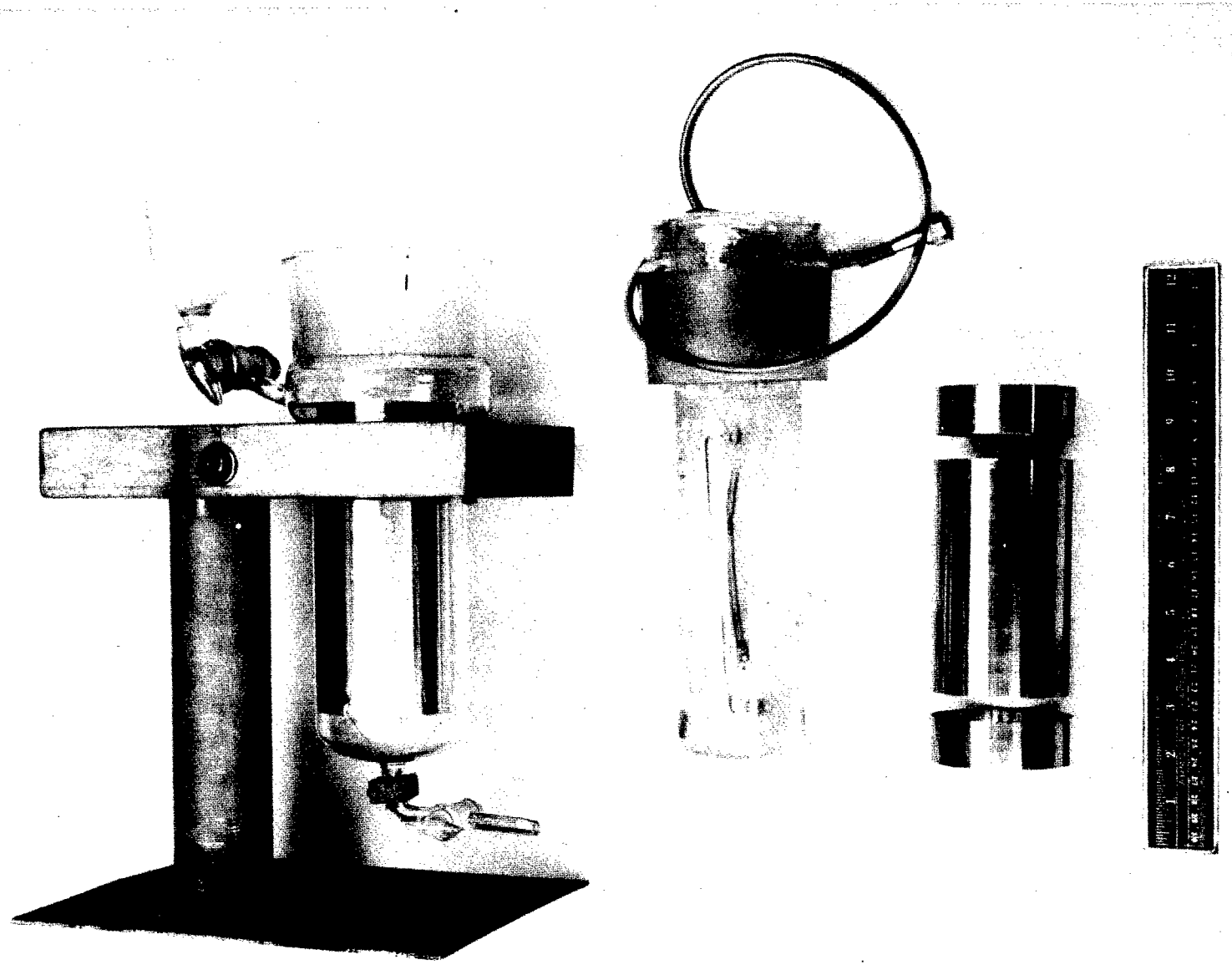


Figure 5. EXPERIMENTAL MEASURING CELL

SECTION II

METHOD

A. Measurement of Dielectric Constant and Dissipation Factor

1. Procedure

Six measuring cells of the guarded type are disassembled and cleaned by shaking with clean dry acetone. After drying, the cells are assembled and placed in the test chamber. The capacitance while empty is measured, using the substitution method wherein the high lead to the cell (K Figure 2) is connected for one measurement and then disconnected for another measurement. This procedure effectively eliminates the capacitance and losses of the leads. It has been found that the value of capacitance while empty does not vary significantly with temperature; however, due to reassembly, a slight change in value may occur so that it is necessary to determine the empty capacitance after each reassembly.

The cells are then filled with the fuels to be measured and the temperature is adjusted until a glass stem thermometer placed near the cells indicates the desired temperature. After holding the temperature constant for 30 minutes, the capacitance of the filled cells is measured by the substitution method. Two measurements are made at 32°F (0°C) to make sure cooling to -65°F (-54°C) has not changed the fuel characteristics.

During the test run it is necessary to open the top of the test chamber. The top is equipped with an automatic switch so that when opened the fans are cut off. No change in cell temperature is detected due to this brief opening.

Periodic calibration of the measuring cells is made with chemically pure **benzene.** Corrections of the guarded Balsbaugh cell have been negligible. The dielectric constant of the fuel, therefore, is

simply the ratio of the capacitance while full to the capacitance while empty.

2. Operation of Coupling Circuit

Referring to Figure 2, the resistors R_s and R_t and the capacitors C_s and C_t comprise the Wagner ground coupling circuit. The values of R_s and R_t should roughly conform to the values of the bridge ratio arms R_A and R_B, respectively. The function of the coupling circuit is to adjust the potential of the guard circuit, including the shields and the guard ring of the measuring cell, to ground potential. When this condition is achieved there can be no charging current through the terminal capacitance, guard ring to ground plate of the measuring cell, and therefore no bridge current shunting the direct capacitance of the cell.

In practice, successive balances are made with the switch S alternately opened and closed. With S open, C_b and C_n are adjusted until the oscilloscope indicates a null. Switch S is closed, usually upsetting the null indication; Rs and Cs are adjusted until a null is again indicated. This process is continued until no change occurs when S is opened or closed.

B. Density Measurement

Determination of fuel density was made with special pycnometers calibrated to indicate true volume. This method, described in A. S. T. M. Specification D-941-57T, gives results which are accurate to within .05 per cent. Constant temperature liquid baths were constructed using transparent Dewar flasks so the pycnometer graduations may be read without

lifting the pycnometer out of the bath. Density in grams per cc is converted to density in pounds per gallon by multiplying by 8.3454.

C. Capacity Index

The capacity index is defined in OSRD Report No. 4016, June 30, 1944, "Some Characteristics of Aircraft Engine Fuels: Their Influence on Capacitor Type Tank Gages." It is the ratio

$$\frac{K-1}{D}$$

where K is the fuel dielectric constant and D the fuel density.

The OSRD report shows that the indication of a capacitance type fuel gage is proportional to the product of the mass and the capacity index provided the liquid in the tank has a constant surface area.

D. Effect of Moisture Content

1) Electrical Measurements

Because of the small effects of moisture content indicated in previous investigations, it was necessary to use a larger, more accurate cell in the determination of dielectric constant and dissipation factor.

Three specimens of each of grades 91/98, 100/130, 115/145 and JP-3 and one specimen of grade JP-4 were measured at 77°F and 400 cps as received and after saturation with distilled water, synthetic hard water, and synthetic sea water. Electrical measurements were made after all specimens had settled 24 hours, and the specimen used was drawn off the upper portion of the saturated fuel to eliminate excess water.

2) Moisture Content Measurements

The amount of water present in the fuels as received and after saturation was determined by the Karl Fischer method. This method is

accurate to within approximately 3 parts per million (milligrams of H_2O per liter of fuel).

E. Handling of Specimens

Specimens were stored in their original containers in an outdoor enclosure protected from the weather. Before measurements one quart of each specimen was processed to distill off 10 per cent by volume. This portion was designated with the suffix "E" and was treated as a distinctly different specimen. All specimens were handled in brown glass bottles to prevent possible formation of precipitate due to sunlight. One pint of each specimen was retained after electrical measurements.

SECTION III
RESULTS

A. Dielectric Constant, Density, and Capacity Index versus Temperature

Dielectric constant at 400 cps and density were measured and capacity index was calculated for about one of every five test specimens through a temperature range of -65°F (-54°C) to 130°F (54°C) with results given in Tables 1 to 7 inclusive and plotted on Figures 6 to 28 inclusive. The group consisted of the following number of specimens of each grade of fuel:

Grade 91/98	- 10
Grade 100/130	- 9
Grade 115/145	- 9
Grade JP-1	- 6
Grade JP-3	- 6
Grade JP-4	- 6
Experimental	- 4.

In these and all following results, the suffix "E" designates a specimen after evaporation of 10% by volume.

The mean slopes of the dielectric constant versus temperature curves listed above were calculated for each grade of fuel to be used in determining the mean temperature coefficient and are presented in Table 20. The density of all specimens was practically a linear function of temperature. Data has been compiled to show this relation and is presented in a subsequent section.

Two specimens exhibited peculiar behavior due to temperature change. Initially the dielectric constant of specimen No. 248 measured 2.127 at 32°F (0°C). After cooling to -65°F (-54°C) and then reheating to 32°F (0°C) the fuel measured 2.149. A fresh sample was used for the high temperatures, giving a measurement of 2.052 at 130°F (54°C). The sample which had been subjected to the low temperatures measured 2.092 at 130°F (54°C). Sample No. 365E also exhibited a behavior similar to that of No. 248. Initially at 32°F (0°C), its dielectric constant measured 1.994. After cooling to -65°F (-54°C) and then reheating to 32°F (0°C), the fuel measured 1.984. After further heating to 130°F (54°C) and then recooling to 32°F (0°C), the dielectric constant measured 1.972. These effects were demonstrated by several repetitions of the experiment.

B. Dielectric Constant, Density, and Capacity Index at 32°F (0°C): All Specimens.

The dielectric constant at 400 cps and the density were measured, and capacity index calculated for all specimens at 32°F (0°C). These results are presented in Tables 8 to 14 inclusive, and are shown graphically in Figures 29 to 33. Figures 34 to 38 present plots of dielectric constant versus density at 32°F (0°C) and a line of regression, determined by statistical means. ("Methods of Correlation Analysis",

M. Ezekiel, Wiley and Sons, 1941, Chapter 8). This line is the best straight line which can be drawn to depict the correlation between the two variables. The figures also give the per unit correlation, 1.0 being perfect correlation.

Figures 39 to 43 present plots of capacity index versus dielectric constant at 32°F (0°C) and lines of regression for these two variables.

Figures 44 and 45 show lines of regression of dielectric constant versus density and capacity index versus dielectric constant for all grades plotted on one chart. Also included on these charts are lines of regression for a combination of 51 specimens of grade 100/130 and 44 specimens of grade 115/145 fuels; and a combination of 51 specimens of grade 100/130, 44 samples of grade 115/145, and 35 samples of grade JP-3 fuels.

Tables 15 and 16 present the mean, maximum, and minimum values of dielectric constant, density, and capacity index of both the unevaporated and evaporated samples at 32°F (0°C) for each grade and for combinations of grades 100/130 and 115/145, and grades 100/130, 115/145, and JP-3. From these tables the effect of evaporation of 10% by volume was determined and is presented in Table 17.

C. Dissipation Factor

The electrical measuring circuit, using the Balsbaugh cell, is sensitive only to values of dissipation factor greater than about 0.0007 at 400 cps. Therefore, only dissipation factors exceeding this value are reported in Table 18.

D. Slope of Density versus Temperature Curves as a Function of Density

The density versus temperature curves of 36 fuel specimens were analyzed and equations were derived which predict density values at various temperatures.

Table 19 gives the slope of the density versus temperature characteristic for each specimen considered in this determination. The slope appears to be approximately a linear function of density at 32°F (0°C) as shown in Figure 46. The per unit correlation of the line of regression was determined to be 0.888, unity being perfect correlation.

Based on these calculations, the general equation for determining density of temperature T when the density at 32°F is known becomes

$$D_T = D_{32} (.983822 + .00050556T) - .0069302T + .221766$$

where D is the density in pounds per gallon, and T is the temperature in degrees F.

Specific equations which apply to the end points of the temperature range are:

$$D_{-65} = D_{32} (.95096) + .67223$$

$$D_{130} = D_{32} (1.04954) - .67916$$

E. Dielectric Constant, Density, and Capacity Index at -65°F (-54°C), 32°F (0°C), and 130°F (54°C)

Using the mean slope of the dielectric constant versus temperature curves and the mean value of dielectric constant, the mean temperature coefficient of dielectric constant was determined for each grade of fuel and is presented in Table 20. The temperature coefficient is defined by the following equations:

$$K_t = K_{32}\,(1-\alpha(t-32)) \quad \text{or} \quad K_{t'} = K_o\,(1-\alpha' t')$$

where K is the dielectric constant
t is the temperature in degrees F
t' is the temperature in degrees C
α is the temperature coefficient of dielectric constant per degree F
α' is the temperature coefficient of dielectric constant per degree C.

Using this equation, the dielectric constants of all specimens not tested at temperatures other than 32°F (0°C) were calculated at -65°F (-54°C) and 130°F (54°C). Density was determined at these same two temperatures by means of the equations of the preceding section, thereby permitting calculation of the capacity index.

Tables 21 to 26 present the dielectric constant and density and Tables 27 to 32 the capacity index of all specimens at -65°F (-54°C), 32°F (0°C), and 130°F (54°C) for each grade of fuel.

Plots of dielectric constant versus density and capacity index versus dielectric constant at the three temperatures are shown in Figures 47 to 56, inclusive.

F. Effect of Moisture Content

The results of the effect of moisture content investigation using the revised cell are presented in Tables 33, 34 and 35.

G. Chemical Properties versus Dielectric Constant

Attempts to correlate initial boiling point, and lead, sulfur, and aromatic content with dielectric constant showed insignificant correlation. These quantities are presented in Tables 36 to 40, inclusive, and are shown graphically in Figures 57 and 58 for grade 91/98 fuel.

The aniline-gravity constant, however, exhibited a definite relationship to the dielectric constant. This relationship is shown

graphically in Figures 59 to 61 inclusive.

H. Evaluation of New Cell

A calibration at room temperature was performed using chemically pure benzene as a standard liquid. The dielectric constant of the benzene measured 2.277. The accepted value at 77°F is 2.274.

Two gage lines are inscribed on the glass cell at the ground joint so the cell may be assembled the same way each time it is cleaned. Only a slight change in empty capacitance is noted after repeated disassemblies and assemblies.

An investigation was made to determine the changes of the cell capacitance, while empty, during a temperature run. The results of this investigation showed that the changes in empty cell capacitance over the temperature range of -65°F (-54°C) to 130°F (54°C) are insignificant considering the sensitivity of the bridge circuit.

I. Effect of Storage and Handling

Three samples of fuel, one from the fueling truck, one from a B-36 aircraft before flight, and one from the same B-36 after flight, were tested at 77°F (25°C) and 400 cps to determine the effect of storage and handling upon the electrical and physical properties of the fuel. To obtain greater sensitivity and accuracy, the experimental cell was used in the measurement of dielectric properties. The results of these tests are presented in Table 41.

TABLE 1

Dielectric Constant at 400 Cycles per Second
Density in Air (Lb/Gallon), and Capacity Index
Grade 91/98 Fuels

Specimen Number		Temperature, Degrees F					
		-65(-54°C)	-40(-40°C)	-4(-20°C)	32(0°C)	77(25°C)	130(54°C)
219	(DC)	2.083	2.068	2.031	2.000	1.967	1.928
	(D)	6.594	6.491	6.339	6.188	5.998	5.779
	(CI)	.1642	.1645	.1626	.1616	.1612	.1606
219E	(DC)	2.089	2.077	2.038	2.018	1.985	1.935
	(D)	6.644	6.540	6.389	6.239	6.049	5.834
	(CI)	.1639	.1647	.1625	.1632	.1628	.1603
223	(DC)	2.050	2.033	2.002	1.968	1.938	1.891
	(D)	6.376	6.270	6.121	5.972	5.785	5.569
	(CI)	.1647	.1648	.1637	.1621	.1622	.1600
223E	(DC)	2.062	2.042	2.013	1.987	1.952	1.908
	(D)	6.411	6.302	6.153	6.003	5.822	5.608
	(CI)	.1657	.1654	.1647	.1644	.1635	.1619
256	(DC)	2.037	2.024	1.999	1.969	1.936	1.896
	(D)	6.339	6.240	6.099	5.959	5.778	5.576
	(CI)	.1636	.1641	.1638	.1626	.1620	.1607
256E	(DC)	2.062	2.040	2.010	1.984	1.953	1.907
	(D)	6.393	6.295	6.152	6.011	5.835	5.629
	(CI)	.1661	.1652	.1642	.1637	.1633	.1611
273	(DC)	2.046	2.034	2.010	1.975	1.944	1.906
	(D)	6.309	6.210	6.070	5.930	5.751	5.549
	(CI)	.1644	.1665	.1664	.1644	.1641	.1633

TABLE 1

(Continued)

Specimen Number		Temperature, Degrees F					
		-65(-54°C)	-40(-40°C)	-4(-20°C)	32(0°C)	77(25°C)	130(54°C)
273E	(DC)	2.055	2.033	2.009	1.986	1.951	1.909
	(D)	6.349	6.251	6.111	5.970	5.796	5.587
	(CI)	.1652	.1653	.1651	.1652	.1641	.1627
307	(DC)	2.095	2.079	2.046	2.008	1.976	1.944
	(D)	6.444	6.346	6.209	6.070	5.895	5.690
	(CI)	.1699	.1700	.1685	.1661	.1656	.1659
307E	(DC)	2.077	2.058	2.035	1.993	1.967	1.926
	(D)	6.476	6.378	6.240	6.100	5.924	5.725
	(CI)	.1663	.1659	.1659	.1628	.1632	.1617
309	(DC)	2.047	2.034	2.001	1.976	1.942	1.903
	(D)	6.291	6.194	6.058	5.922	5.747	5.543
	(CI)	.1664	.1669	.1652	.1648	.1639	.1629
309E	(DC)	2.060	2.041	2.014	1.985	1.953	1.918
	(D)	6.341	6.242	6.103	5.963	5.790	5.584
	(CI)	.1672	.1668	.1661	.1652	.1646	.1644
326	(DC)	2.089	2.066	2.030	2.002	1.973	1.942
	(D)	6.499	6.399	6.255	6.111	5.931	5.723
	(CI)	.1676	.1666	.1647	.1640	.1641	.1646
326E	(DC)	2.088	2.067	2.036	2.004	1.973	1.942
	(D)	6.559	6.459	6.315	6.169	5.986	5.781
	(CI)	.1659	.1652	.1641	.1627	.1625	.1629

TABLE 1

(Continued)

Specimen Number		Temperature, Degrees F					
		-65(-54°C)	-40(-40°C)	-4(-20°C)	32(0°C)	77(25°C)	130(54°C)
352	(DC)	2.104	2.084	2.061	2.027	2.003	1.955
	(D)	6.534	6.441	6.301	6.163	5.986	5.783
	(CI)	.1690	.1683	.1684	.1666	.1676	.1651
352E	(DC)	2.139	2.113	2.082	2.050	2.018	1.974
	(D)	6.585	6.493	6.353	6.213	6.036	5.832
	(CI)	.1730	.1714	.1703	.1690	.1687	.1670
365	(DC)	2.079	2.050	2.005	1.968	1.952	1.918
	(D)	6.327	6.231	6.090	5.946	5.766	5.558
	(CI)	.1705	.1685	.1650	.1628	.1651	.1652
365E	(DC)	2.051	2.036	2.016	1.994	1.949	1.898
	(D)	6.426	6.327	6.103	6.044	5.864	5.650
	(CI)	.1636	.1637	.1665	.1643	.1618	.1589
400	(DC)	2.085	2.054	2.029	1.997	1.965	1.941
	(D)	6.549	6.446	6.300	6.153	5.970	5.761
	(CI)	.1657	.1635	.1633	.1620	.1616	.1633
400E	(DC)	2.074	2.056	2.026	1.997	1.960	1.923
	(D)	6.591	6.491	6.345	6.199	6.017	5.807
	(CI)	.1629	.1627	.1617	.1608	.1595	.1589

TABLE 2

Dielectric Constant at 400 Cycles per Second
Density in Air (Lb/Gallon), and Capacity Index
Grade 100/130 Fuels

Specimen Number		Temperature, Degrees F					
		-65(-54°C)	-40(-40°C)	-4(-20°C)	32(0°C)	77(25°C)	130(54°C)
210	(DC)	2.098	2.069	2.049	2.015	1.980	1.934
	(D)	6.450	6.351	6.210	6.076	5.896	5.683
	(CI)	.1702	.1683	.1689	.1671	.1662	.1643
210E	(DC)	2.091	2.080	2.049	2.021	1.993	1.946
	(D)	6.520	6.418	6.275	6.132	5.952	5.738
	(CI)	.1673	.1683	.1672	.1665	.1668	.1649
237	(DC)	2.041	2.024	1.995	1.967	1.933	1.887
	(D)	6.312	6.217	6.082	5.944	5.775	5.577
	(CI)	.1650	.1647	.1636	.1627	.1616	.1591
237E	(DC)	2.049	2.029	2.001	1.977	1.944	1.904
	(D)	6.369	6.275	6.136	5.994	5.822	5.623
	(CI)	.1647	.1640	.1632	.1630	.1622	.1608
240	(DC)	2.029	2.008	1.986	1.953	1.920	1.886
	(D)	6.266	6.169	6.029	5.891	5.715	5.514
	(CI)	.1642	.1634	.1635	.1618	.1610	.1607
240E	(DC)	2.044	2.024	1.998	1.978	1.938	1.898
	(D)	6.325	6.228	6.086	5.949	5.776	5.568
	(CI)	.1651	.1644	.1640	.1644	.1624	.1613
285	(DC)	2.058	2.032	2.008	1.977	1.954	1.915
	(D)	6.260	6.161	6.023	5.884	5.707	5.506
	(CI)	.1690	.1675	.1674	.1660	.1672	.1662

TABLE 2

(Continued)

Specimen Number		Temperature, Degree F					
		-65(-54°C)	-40(-40°C)	-4(-20°C)	32(0°C)	77(25°C)	130(54°C)
285E	(DC)	2.050	2.024	2.006	1.975	1.946	1.913
	(D)	6.303	6.207	6.069	5.931	5.757	5.552
	(CI)	.1666	.1650	.1658	.1644	.1643	.1644
300	(DC)	2.099	2.085	2.047	2.016	1.980	1.950
	(D)	6.451	6.353	6.214	6.075	5.900	5.698
	(CI)	.1704	.1708	.1685	.1672	.1661	.1667
300E	(DC)	2.123	2.098	2.066	2.038	2.007	1.965
	(D)	6.521	6.425	6.286	6.146	5.971	5.768
	(CI)	.1722	.1709	.1696	.1689	.1686	.1673
330	(DC)	2.108	2.089	2.061	2.032	1.996	1.953
	(D)	6.534	6.433	6.292	6.144	5.965	5.757
	(CI)	.1696	.1693	.1686	.1680	.1670	.1655
330E	(DC)	2.107	2.094	2.069	2.041	1.995	1.959
	(D)	6.582	6.484	6.339	6.196	6.016	5.806
	(CI)	.1682	.1687	.1686	.1680	.1654	.1652
367	(DC)	2.104	2.085	2.048	2.008	1.982	1.942
	(D)	6.520	6.418	6.274	6.128	5.946	5.734
	(CI)	.1693	.1690	.1670	.1645	.1652	.1643
367E	(DC)	2.124	2.104	2.074	2.044	2.018	1.968
	(D)	6.618	6.519	6.290	6.228	6.047	5.835
	(CI)	.1698	.1694	.1707	.1676	.1683	.1659

TABLE 2

(Continued)

Specimen Number		Temperature, Degree F					
		-65(-54°C)	-40(-40°C)	-4(-20°C)	32(0°C)	77(25°C)	130(54°C)
378	(DC)	2.119	2.096	2.066	2.020	1.995	1.954
	(D)	6.487	6.386	6.241	6.093	5.909	5.697
	(CI)	.1725	.1716	.1708	.1674	.1684	.1675
378E	(DC)	2.133	2.110	2.084	2.049	2.011	1.966
	(D)	6.577	6.474	6.331	6.184	6.000	5.790
	(CI)	.1723	.1715	.1712	.1696	.1685	.1668
401	(DC)	2.023	2.005	1.977	1.950	1.919	1.874
	(D)	6.302	6.204	6.061	5.919	5.737	5.529
	(CI)	.1623	.1620	.1612	.1605	.1602	.1581
401E	(DC)	2.031	2.014	1.989	1.969	1.941	1.891
	(D)	6.352	6.254	6.111	5.965	5.784	5.580
	(CI)	.1623	.1621	.1618	.1624	.1627	.1597

TABLE 3

Dielectric Constant at 400 Cycles per Second

Density in Air (Lb/Gallon), and Capacity Index

Grade 115/145 Fuels

Specimen Number		Temperature, Degree F					
		-65(-54°C)	-40(-40°C)	-4(-20°C)	32(0°C)	77(25°C)	130(54°C)
208	(DC)	2.039	2.016	1.990	1.962	1.927	1.890
	(D)	6.289	6.191	6.049	5.908	5.731	5.525
	(CI)	.1652	.1641	.1637	.1628	.1618	.1611
208E	(DC)	2.037	2.025	1.995	1.972	1.943	1.900
	(D)	6.342	6.243	6.101	5.959	5.782	5.575
	(CI)	.1635	.1642	.1631	.1631	.1631	.1614
236	(DC)	2.063	2.039	2.011	1.977	1.945	1.895
	(D)	6.296	6.196	6.057	5.918	5.746	5.543
	(CI)	.1689	.1677	.1669	.1651	.1645	.1615
236E	(DC)	2.067	2.043	2.014	1.987	1.956	1.921
	(D)	6.344	6.247	6.109	5.973	5.800	5.596
	(CI)	.1682	.1670	.1660	.1653	.1649	.1646
260	(DC)	2.049	2.034	2.005	1.976	1.949	1.914
	(D)	6.305	6.207	6.070	5.927	5.753	5.551
	(CI)	.1664	.1666	.1656	.1647	.1650	.1647
260E	(DC)	2.043	2.028	2.008	1.981	1.934	1.892
	(D)	6.366	6.268	6.129	5.984	5.813	5.610
	(CI)	.1639	.1640	.1645	.1639	.1607	.1590
281	(DC)	2.064	2.042	2.017	1.984	1.957	1.917
	(D)	6.278	6.181	6.041	5.902	5.725	5.523
	(CI)	.1695	.1686	.1683	.1667	.1672	.1660

TABLE 3

(Continued)

Specimen Number		Temperature, Degree F					
		-65(-54°C)	-40(-40°C)	-4(-20°C)	32(0°C)	77(25°C)	130(54°C)
281E	(DC)	2.066	2.037	2.021	1.990	1.952	1.920
	(D)	6.321	6.221	6.086	5.945	5.768	5.568
	(CI)	.1686	.1667	.1678	.1665	.1650	.1652
313	(DC)	2.042	2.029	2.002	1.965	1.937	1.903
	(D)	6.277	6.190	6.047	5.909	5.735	5.531
	(CI)	.1660	.1662	.1657	.1633	.1634	.1633
313E	(DC)	2.055	2.037	2.011	1.984	1.950	1.915
	(D)	6.347	6.249	6.111	5.971	5.793	5.592
	(CI)	.1662	.1659	.1654	.1648	.1640	.1636
334	(DC)	2.045	2.017	1.995	1.964	1.930	1.895
	(D)	6.238	6.138	6.000	5.862	5.687	5.483
	(CI)	.1675	.1657	.1658	.1644	.1635	.1632
334E	(DC)	2.033	2.017	1.987	1.964	1.930	1.899
	(D)	6.290	6.190	6.050	5.910	5.737	5.534
	(CI)	.1642	.1643	.1631	.1631	.1621	.1625
341	(DC)	2.053	2.034	2.008	1.977	1.944	1.902
	(D)	6.317	6.218	6.078	5.942	5.762	5.559
	(CI)	.1667	.1663	.1658	.1644	.1638	.1623
341E	(DC)	2.067	2.045	2.015	1.991	1.961	1.918
	(D)	6.363	6.266	6.124	5.986	5.806	5.601
	(CI)	.1677	.1668	.1657	.1656	.1655	.1639

TABLE 3

(Continued)

Specimen Number		Temperature, Degree F					
		-65(-54°C)	-40(-40°C)	-4(-20°C)	32(0°C)	77(25°C)	130(54°C)
342	(DC)	2.024	2.013	1.987	1.966	1.916	1.878
	(D)	6.274	6.176	6.035	5.899	5.720	5.518
	(CI)	.1632	.1640	.1635	.1638	.1601	.1591
342E	(DC)	2.031	2.020	1.995	1.969	1.936	1.888
	(D)	6.326	6.226	6.086	5.947	5.773	5.566
	(CI)	.1630	.1638	.1635	.1629	.1621	.1595
402	(DC)	2.043	2.025	1.995	1.967	1.938	1.898
	(D)	6.278	6.179	6.036	5.894	5.715	5.504
	(CI)	.1661	.1659	.1648	.1641	.1641	.1632
402E	(DC)	2.037	2.022	1.998	1.967	1.938	1.895
	(D)	6.327	6.227	6.085	5.942	5.761	5.553
	(CI)	.1639	.1641	.1640	.1627	.1628	.1612

TABLE 4

Dielectric Constant at 400 Cycles per Second

Density in Air (Lb/Gallon), and Capacity Index

Grade JP-1 Fuels

Specimen Number		Temperature, Degree F					
		-65(-54°C)	-40(-40°C)	-4(-20°C)	32(0°C)	77(25°C)	130(54°C)
233	(DC)	2.199	2.177	2.149	2.123	2.080	2.044
	(D)	7.013	6.928	6.806	6.687	6.531	6.353
	(CI)	.1710	.1699	.1688	.1680	.1654	.1644
233E	(DC)	2.187	2.168	2.142	2.119	2.084	2.043
	(D)	7.027	6.951	6.820	6.699	6.545	6.368
	(CI)	.1689	.1681	.1675	.1671	.1656	.1638
241	(DC)	2.205	2.184	2.147	2.120	2.081	2.036
	(D)	6.987	6.899	6.772	6.648	6.489	6.307
	(CI)	.1725	.1716	.1694	.1685	.1666	.1643
241E	(DC)	2.188	2.172	2.143	2.119	2.071	2.033
	(D)	6.996	6.908	6.782	6.655	6.495	6.314
	(CI)	.1698	.1697	.1685	.1681	.1649	.1636
264	(DC)	2.255	2.236	2.212	2.179	2.143	2.107
	(D)	7.252	7.167	7.045	6.926	6.772	6.595
	(CI)	.1702	.1722	.1720	.1629	.1688	.1679
264E	(DC)	2.261	2.236	2.217	2.182	2.148	2.103
	(D)	7.273	7.187	7.066	6.943	6.793	6.616
	(CI)	.1702	.1720	.1722	.1702	.1690	.1667
290	(DC)	2.253	2.231	2.210	2.174	2.146	2.101
	(D)	7.271	7.184	7.059	6.936	6.783	6.599
	(CI)	.1723	.1714	.1714	.1693	.1690	.1668

TABLE 4

(Continued)

Specimen Number		Temperature, Degree F					
		-65(-54°C)	-40(-40°C)	-4(-20°C)	32(0°C)	77(25°C)	130(54°C)
290E	(DC)	2.263	2.233	2.214	2.180	2.143	2.109
	(D)	7.286	7.200	7.074	6.953	6.795	6.615
	(CI)	.1733	.1713	.1716	.1697	.1682	.1676
336	(DC)	2.270	2.249	2.215	2.183	2.148	2.108
	(D)	7.265	7.180	7.059	6.938	6.783	6.603
	(CI)	.1748	.1740	.1721	.1705	.1692	.1678
336E	(DC)	2.274	2.253	2.213	2.186	2.148	2.121
	(D)	7.288	7.202	7.081	6.955	6.802	6.628
	(CI)	.1748	.1740	.1713	.1705	.1688	.1691
364	(DC)	2.269	2.247	2.221	2.182	2.149	2.108
	(D)	7.241	7.158	7.037	6.915	6.762	6.587
	(CI)	.1753	.1742	.1735	.1709	.1699	.1682
364E	(DC)	2.265	2.245	2.217	2.185	2.147	2.112
	(D)	7.254	7.169	7.049	6.926	6.773	6.601
	(CI)	.1744	.1737	.1726	.1711	.1693	.1685

TABLE 5

Dielectric Constant at 400 Cycles per Second

Density in Air (Lb/Gallon), and Capacity Index

Grade JP-3 Fuels

Specimen Number		Temperature, Degrees F					
		-65(-54°C)	-40(-40°C)	-4(-20°C)	32(0°C)	77(25°C)	130(54°C)
209	(DC)	2.235	2.205	2.179	2.143	2.108	2.069
	(D)	7.178	7.090	6.959	6.827	6.665	6.477
	(CI)	.1721	.1700	.1694	.1674	.1662	.1650
209E	(DC)	2.227	2.214	2.189	2.160	2.132	2.089
	(D)	7.301	7.212	7.084	6.956	6.796	6.609
	(CI)	.1681	.1683	.1678	.1668	.1666	.1648
248	(DC)	2.218	2.197	2.165	2.127	2.093	2.052
	(D)	7.011	6.920	6.793	6.666	6.504	6.319
	(CI)	.1737	.1730	.1715	.1691	.1681	.1665
248E	(DC)	2.247	2.228	2.188	2.159	2.122	2.089
	(D)	7.150	7.059	6.933	6.810	6.650	6.466
	(CI)	.1744	.1740	.1714	.1702	.1687	.1684
277	(DC)	2.132	2.117	2.089	2.058	2.026	1.989
	(D)	6.697	6.601	6.466	6.327	6.158	5.961
	(CI)	.1672	.1692	.1684	.1672	.1666	.1659
277E	(DC)	2.145	2.125	2.100	2.069	2.036	1.994
	(D)	6.775	6.678	6.543	6.405	6.234	6.036
	(CI)	.1669	.1685	.1681	.1669	.1662	.1647
283	(DC)	2.169	2.151	2.131	2.098	2.066	2.030
	(D)	6.892	6.796	6.665	6.531	6.366	6.172
	(CI)	.1696	.1694	.1697	.1681	.1675	.1669

TABLE 5

(Continued)

Specimen Number		Temperature, Degrees F					
		-65(-54°C)	-40(-40°C)	-4(-20°C)	32(0°C)	77(25°C)	130(54°C)
283E	(DC)	2.180	2.162	2.143	2.109	2.080	2.046
	(D)	6.993	6.897	6.765	6.630	6.467	6.275
	(CI)	.1687	.1685	.1690	.1673	.1670	.1667
359	(DC)	2.133	2.113	2.086	2.054	2.025	1.994
	(D)	6.718	6.620	6.483	6.346	6.175	5.971
	(CI)	.1687	.1681	.1675	.1661	.1660	.1665
359E	(DC)	2.154	2.131	2.101	2.072	2.042	1.999
	(D)	6.803	6.708	6.569	6.431	6.267	6.059
	(CI)	.1696	.1686	.1676	.1667	.1663	.1649
403	(DC)	2.210	2.179	2.155	2.120	2.080	2.042
	(D)	6.982	6.893	6.766	6.640	6.481	6.278
	(CI)	.1733	.1710	.1707	.1687	.1666	.1660
403E	(DC)	2.212	2.193	2.161	2.132	2.096	2.053
	(D)	7.129	7.041	6.916	6.790	6.630	6.394
	(CI)	.1700	.1694	.1679	.1667	.1653	.1647

TABLE 6

Dielectric Constant at 400 Cycles per Second

Density in Air (Lb/Gallon), and Capacity Index

Grade JP-4 Fuels

Specimen Number		Temperature, Degrees F					
		-65(-54°C)	-40(-40°C)	-4(-20°C)	32(0°C)	77(25°C)	130(54°C)
415 MLF 5411	(DC)	2.128	2.103	2.080	2.051	2.015	1.986
	(D)	6.685	6.596	6.474	6.347	6.190	6.010
	(CI)	.1687	.1672	.1668	.1656	.1640	.1641
415E	(DC)	2.141	2.121	2.094	2.064	2.034	1.994
	(D)	6.735	6.647	6.522	6.398	6.242	6.060
	(CI)	.1694	.1686	.1677	.1663	.1657	.1640
417 MLF 5477	(DC)	2.160	2.140	2.112	2.076	2.048	2.019
	(D)	6.860	6.773	6.645	6.517	6.355	6.170
	(CI)	.1691	.1683	.1673	.1651	.1649	.1652
417E	(DC)	2.165	2.140	2.118	2.090	2.065	2.017
	(D)	6.933	6.845	6.719	6.588	6.431	6.245
	(CI)	.1680	.1665	.1664	.1655	.1656	.1629
418 MLF 5478	(DC)	2.164	2.146	2.121	2.095	2.061	2.023
	(D)	6.925	6.835	6.710	6.585	6.422	6.234
	(CI)	.1681	.1677	.1671	.1663	.1652	.1641
418E	(DC)	2.182	2.159	2.142	2.106	2.078	2.033
	(D)	6.993	6.902	6.774	6.645	6.487	6.303
	(CI)	.1690	.1679	.1686	.1664	.1662	.1639
419 MLF 5484	(DC)	2.148	2.128	2.095	2.062	2.033	2.002
	(D)	6.776	6.686	6.560	6.434	6.272	6.089
	(CI)	.1694	.1687	.1669	.1651	.1647	.1646

TABLE 6

(Continued)

Specimen Number		Temperature, Degrees F					
		-65(-54°C)	-40(-40°C)	-4(-20°C)	32(0°C)	77(25°C)	130(54°C)
419E	(DC)	2.182	2.143	2.117	2.082	2.053	2.028
	(D)	6.835	6.750	6.625	6.493	6.335	6.148
	(CI)	.1629	.1693	.1686	.1666	.1662	.1672
420 MLF 5494	(DC)	2.135	2.114	2.083	2.050	2.021	1.987
	(D)	6.686	6.595	6.475	6.349	6.190	6.010
	(CI)	.1696	.1689	.1673	.1654	.1649	.1642
420E	(DC)	2.141	2.112	2.085	2.052	2.028	1.984
	(D)	6.735	6.646	6.523	6.399	6.242	6.060
	(CI)	.1694	.1673	.1663	.1644	.1647	.1624
421 MLF 5541	(DC)	2.163	2.140	2.109	2.077	2.046	2.014
	(D)	6.849	6.761	6.633	6.503	6.343	6.159
	(CI)	.1698	.1686	.1672	.1656	.1649	.1646
421E	(DC)	2.176	2.145	2.119	2.088	2.062	2.023
	(D)	6.910	6.824	6.695	6.569	6.410	6.220
	(CI)	.1702	.1678	.1671	.1656	.1657	.1645

TABLE 7

Dielectric Constant at 400 Cycles per Second

Density in Air (lb/Gallon), and Capacity Index

Special Fuels

Specimen Number			Temperature, Degrees F					
			-65(-54°C)	-40(-40°C)	-4(-20°C)	32(0°C)	77(25°C)	130(54°C)
380	MLF-4890	(DC)	2.135	2.115	2.080	2.052	2.020	1.974
		(D)	6.640	6.537	6.391	6.245	6.064	5.851
		(CI)	.1709	.1706	.1690	.1685	.1682	.1664
380E		(DC)	2.150	2.125	2.094	2.064	2.033	1.991
		(D)	6.709	6.608	6.465	6.318	6.139	5.930
		(CI)	.1714	.1702	.1692	.1684	.1683	.1671
381	MLF-5209	(DC)	2.121	2.102	2.072	2.041	2.007	1.950
		(D)	6.691	6.590	6.445	6.300	6.172	5.905
		(CI)	.1675	.1672	.1663	.1652	.1632	.1609
381E		(DC)	2.130	2.108	2.085	2.058	2.020	1.969
		(D)	6.761	6.660	6.516	6.371	6.192	5.982
		(CI)	.1671	.1664	.1665	.1661	.1647	.1620
382	MLF-4891	(DC)	2.513	2.474	2.410	2.333	2.261	2.183
		(D)	6.634	6.533	6.388	6.242	6.060	5.845
		(CI)	.2281	.2256	.2207	.2136	.2081	.2024
382E		(DC)	2.456	2.400	2.348	2.297	2.229	2.154
		(D)	6.705	6.605	6.461	6.317	6.139	5.928
		(CI)	.2172	.2120	.2086	.2053	.2002	.1947
383	MLF-4889	(DC)	2.122	2.104	2.073	2.044	2.005	1.963
		(D)	6.632	6.529	6.384	6.239	6.055	5.842
		(CI)	.1692	.1691	.1681	.1673	.1660	.1648
383E		(DC)	2.132	2.104	2.076	2.049	2.013	1.971
		(D)	6.691	6.590	6.443	6.295	6.113	5.899
		(CI)	.1692	.1675	.1670	.1666	.1657	.1646

TABLE 8

Dielectric Constant, Density

and Capacity Index at 32°F(0°C)

Grade 91/98 Fuels

Specimen Number	Dielectric Constant at 400 Cps	Density Pounds per Gallon	Capacity Index (K-1)/D
200	1.999	6.109	.1635
200E	2.007	6.186	.1628
201	1.970	5.928	.1636
201E	1.975	5.980	.1630
204	1.987	5.970	.1653
204E	1.998	6.018	.1658
205	1.969	5.909	.1640
205E	1.978	6.004	.1629
215	1.972	5.939	.1637
215E	1.985	6.008	.1639
216	1.964	5.934	.1625
216E	1.983	5.995	.1640
217	1.972	5.961	.1631
217E	1.987	6.029	.1637
219	2.000	6.188	.1616
219E	2.018	6.239	.1632
223	1.968	5.972	.1621
223E	1.987	6.003	.1644

TABLE 8

(Continued)

Specimen Number	Dielectric Constant at 400 Cps	Density Pounds per Gallon	Capacity Index (K-1)/D
227	2.013	6.237	.1624
227E	2.032	6.297	.1639
235	1.979	5.992	.1634
235E	1.989	6.045	.1636
238	1.973	5.951	.1635
238E	1.979	5.994	.1634
239	1.966	5.950	.1624
239E	1.971	6.001	.1618
242	1.968	5.974	.1620
242E	1.976	6.004	.1626
247	1.981	5.984	.1639
247E	1.979	6.026	.1625
252	2.008	6.050	.1666
252E	2.018	6.095	.1670
253	1.997	6.112	.1631
253E	2.001	6.179	.1620
256	1.969	5.959	.1626
256E	1.984	6.011	.1637
261	1.982	6.050	.1623
261E	1.995	6.090	.1634
265	1.970	5.959	.1628

TABLE 8

(Continued)

Specimen Number	Dielectric Constant at 400 Cps	Density Pounds per Gallon	Capacity Index (K-1)/D
265E	1.977	6.003	.1669
269	1.996	6.065	.1642
269E	2.011	6.095	.1659
270	1.969	5.975	.1622
270E	1.984	6.010	.1637
273	1.975	5.930	.1644
273E	1.986	5.970	.1652
280	1.980	6.002	.1633
280E	1.981	6.033	.1626
286	2.010	6.178	.1635
286E	2.024	6.252	.1638
288	2.007	6.049	.1665
288E	2.010	6.093	.1658
298	1.974	5.919	.1646
298E	1.993	5.966	.1664
299	2.010	6.089	.1659
299E	2.018	6.143	.1657
303	1.973	5.967	.1631
303E	1.972	6.007	.1619
307	2.008	6.070	.1661
307E	1.993	6.100	.1628

TABLE 8

(Continued)

Specimen Number	Dielectric Constant at 400 Cps	Density Pounds per Gallon	Capacity Index (K-1)/D
309	1.976	5.922	.1648
309E	1.985	5.963	.1652
310	1.984	6.052	.1626
310E	1.983	6.097	.1612
323	1.979	5.931	.1651
323E	1.985	5.976	.1683
326	2.002	6.111	.1640
326E	2.004	6.169	.1627
328	2.015	6.112	.1661
328E	2.029	6.170	.1668
332	1.973	5.959	.1633
332E	1.978	5.997	.1631
335	2.008	6.126	.1645
335E	2.019	6.181	.1649
340	1.980	5.939	.1650
340E	1.983	5.989	.1641
346	1.975	5.929	.1644
346E	1.970	5.977	.1623
349	2.013	6.206	.1644
349E	2.051	6.262	.1629
352	2.027	6.163	.1666
352E	2.050	6.213	.1690

TABLE 8

(Continued)

Specimen Number	Dielectric Constant at 400 Cps	Density Pounds per Gallon	Capacity Index (K-1)/D
354	1.973	5.931	.1641
354E	1.983	5.983	.1643
362	1.976	6.046	.1614
362E	1.980	6.085	.1611
363	1.992	6.138	.1616
363E	2.005	6.210	.1618
365	1.968	5.946	.1628
365E	1.994	6.044	.1643
371	2.030	6.160	.1672
371E	2.047	6.218	.1684
373	2.016	6.120	.1660
373E	2.028	6.184	.1662
387	1.981	6.044	.1623
387E	1.991	6.090	.1627
392	1.962	5.896	.1632
392E	1.972	5.941	.1636
396	1.971	5.920	.1640
396E	1.978	5.971	.1638
398	2.038	6.177	.1680
398E	2.050	6.240	.1683
400	1.997	6.153	.1620
400E	1.997	6.199	.1608

TABLE 8

(Continued)

Specimen Number	Dielectric Constant at 400 Cps	Density Pounds per Gallon	Capacity Index (K-1)/D
406	1.988	6.066	.1629
406E	2.005	6.094	.1649
412	1.983	6.061	.1622
412E	1.989	6.096	.1622
414	2.010	6.087	.1659
414E	2.022	6.146	.1663

TABLE 9

Dielectric Constant, Density

and Capacity Index at 32°F(0°C)

Grade 100/130 Fuels

Specimen Number	Dielectric Constant at 400 Cps	Density Pounds per Gallon	Capacity Index (K-1)/D
202	1.951	5.889	.1615
202E	1.971	5.956	.1630
207	2.007	6.033	.1669
207E	2.011	6.111	.1654
210	2.015	6.076	.1671
210E	2.021	6.132	.1665
213	1.959	5.889	.1628
213E	1.967	5.951	.1625
214	1.985	5.953	.1655
214E	1.992	6.021	.1648
220	2.019	6.118	.1666
220E	2.025	6.177	.1660
225	1.972	6.019	.1615
225E	1.988	6.070	.1628
230	1.971	5.867	.1655
230E	1.971	5.945	.1634
237	1.967	5.944	.1627
237E	1.977	5.994	.1630
240	1.953	5.891	.1618

TABLE 9

(Continued)

Specimen Number	Dielectric Constant at 400 CPS	Density Pounds per Gallon	Capacity Index (K-1)/D
240E	1.978	5.949	.1644
243	1.960	5.892	.1629
243E	1.962	5.964	.1613
245	1.956	5.842	.1636
245E	1.960	5.879	.1633
250	1.967	5.852	.1652
250E	2.009	5.933	.1701
255	1.962	5.893	.1632
255E	1.965	5.941	.1624
258	1.968	5.946	.1628
258E	1.980	6.000	.1633
263	1.961	5.915	.1625
263E	1.980	5.969	.1642
267	1.959	5.899	.1626
267E	1.967	5.936	.1629
271	1.973	5.895	.1651
271E	1.977	5.942	.1672
272	2.028	6.141	.1674
272E	2.047	6.208	.1686
275	1.976	5.959	.1638
275E	1.984	5.984	.1644

TABLE 9

(Continued)

Specimen Number	Dielectric Constant at 400 Cps	Density Pounds per Gallon	Capacity Index (K-1)/D
279	1.970	5.931	.1635
279E	1.983	5.965	.1648
285	1.977	5.884	.1660
285E	1.975	5.931	.1644
289	1.972	5.969	.1628
289E	1.972	6.005	.1619
291	1.960	5.922	.1621
291E	1.976	5.966	.1636
297	2.029	6.137	.1677
297E	2.035	6.181	.1674
300	2.016	6.075	.1672
300E	2.038	6.146	.1689
304	1.966	5.896	.1638
304E	1.973	5.961	.1632
314	1.969	5.894	.1644
314E	1.967	5.948	.1626
319	2.015	6.093	.1666
319E	2.049	6.166	.1701
321	1.979	5.950	.1645
321E	1.998	5.995	.1665
327	1.991	6.046	.1639
327E	2.005	6.116	.1643

TABLE 9

(Continued)

Specimen Number	Dielectric Constant at 400 Cps	Density Pounds per Gallon	Capacity Index (K-1)/D
330	2.032	6.144	.1680
330E	2.041	6.196	.1680
331	1.964	5.889	.1637
331E	1.979	5.939	.1648
333	2.007	6.122	.1645
333E	2.025	6.181	.1658
339	1.985	5.950	.1655
339E	1.994	5.996	.1658
343	1.991	5.980	.1657
343E	2.000	6.033	.1658
350	1.962	5.862	.1641
350E	1.968	5.914	.1637
351	2.048	6.169	.1699
351E	2.066	6.249	.1706
356	1.968	5.893	.1643
356E	1.969	5.947	.1629
358	1.964	5.900	.1634
358E	1.967	5.938	.1628
367	2.008	6.128	.1645
367E	2.044	6.228	.1676
370	2.018	6.070	.1677
370E	2.037	6.135	.1690

TABLE 9

(Continued)

Specimen Number	Dielectric Constant at 400 Cps	Density Pounds per Gallon	Capacity Index (K-1)/D
378	2.020	6.093	.1674
378E	2.049	6.184	.1696
386	1.968	5.921	.1635
386E	1.976	5.980	.1632
393	1.963	5.889	.1635
393E	1.981	5.979	.1641
395	2.003	6.026	.1664
395E	2.006	6.082	.1654
399	2.019	6.048	.1685
399E	2.012	6.108	.1657
401	1.950	5.919	.1605
401E	1.969	5.965	.1624
405	2.022	6.145	.1663
405E	2.039	6.191	.1678
409	1.966	5.958	.1621
409E	1.975	5.979	.1631
413	2.017	6.122	.1661
413E	2.033	6.175	.1673

TABLE 10

Dielectric Constant, Density

and Capacity Index at 32°F(0°C)

Grade 115/145 Fuels

Specimen Number	Dielectric Constant at 400 Cps	Density Pounds per Gallon	Capacity Index (K-1)/D
206	1.974	5.880	.1656
206E	1.975	6.001	.1625
208	1.962	5.908	.1628
208E	1.972	5.959	.1631
212	1.969	5.924	.1636
212E	1.983	5.995	.1640
218	1.966	5.974	.1617
218E	1.985	6.033	.1633
226	1.947	5.840	.1622
226E	1.967	5.884	.1644
231	1.969	5.889	.1646
231E	1.968	5.935	.1631
236	1.977	5.918	.1651
236E	1.987	5.973	.1653
244	1.971	5.880	.1651
244E	1.973	5.929	.1641
246	1.955	5.891	.1621
246E	1.979	5.940	.1648
251	1.987	5.968	.1654

TABLE 10

(Continued)

Specimen Number	Dielectric Constant at 400 Cps	Density Pounds per Gallon	Capacity Index (K-1)/D
251E	2.004	6.032	.1664
257	1.991	5.898	.1680
257E	1.988	5.948	.1661
260	1.976	5.927	.1647
260E	1.981	5.984	.1639
266	1.955	5.854	.1631
266E	1.966	5.884	.1642
274	1.970	5.885	.1648
274E	1.979	5.973	.1639
278	1.969	5.923	.1636
278E	1.982	5.961	.1647
281	1.984	5.902	.1667
281E	1.990	5.945	.1665
282	1.952	5.855	.1626
282E	1.965	5.903	.1635
284	1.976	5.918	.1649
284E	1.973	5.964	.1631
292	1.968	5.925	.1634
292E	1.981	5.965	.1645
295	2.007	6.041	.1667
295E	2.024	6.104	.1678

TABLE 10

(Continued)

Specimen Number	Dielectric Constant at 400 Cps	Density Pounds per Gallon	Capacity Index (k-1)/D
301	1.959	5.928	.1616
301E	1.998	5.971	.1671
305	1.977	5.899	.1656
305E	1.980	5.944	.1649
308	1.973	5.913	.1646
308E	1.994	5.969	.1665
313	1.965	5.909	.1633
313E	1.984	5.971	.1648
320	1.965	5.897	.1636
320E	1.970	6.013	.1613
324	1.967	5.902	.1638
324E	1.983	5.974	.1645
329	1.977	5.897	.1657
329E	1.997	5.944	.1677
334	1.964	5.862	.1644
334E	1.964	5.910	.1631
341	1.977	5.942	.1644
341E	1.991	5.986	.1656
342	1.966	5.899	.1638
342E	1.969	5.947	.1629
348	1.968	5.911	.1638
348E	1.971	5.962	.1629

TABLE 10

(Continued)

Specimen Number	Dielectric Constant at 400 Cps	Density Pounds per Gallon	Capacity Index (K-1)/D
353	1.952	5.836	.1631
353E	1.963	5.878	.1638
355	1.959	5.848	.1640
355E	1.971	5.896	.1647
366	1.957	5.866	.1631
366E	1.973	5.920	.1644
368	1.964	5.927	.1626
368E	1.986	5.997	.1644
374	1.973	5.888	.1653
374E	1.981	5.944	.1650
376	1.987	5.890	.1676
376E	1.978	5.947	.1645
379	1.964	5.867	.1643
379E	1.974	5.929	.1643
389	1.962	5.853	.1644
389E	1.969	5.864	.1652
390	1.977	5.906	.1654
390E	1.985	5.964	.1652
402	1.967	5.894	.1641
402E	1.967	5.942	.1627
404	1.971	5.923	.1639

TABLE 10

(Continued)

Specimen Number	Dielectric Constant at 400 Cps	Density Pounds per Gallon	Capacity Index (K-1)/D
404E	1.986	5.988	.1647
408	1.955	5.962	.1602
408E	1.978	6.021	.1624
411	1.980	5.894	.1663
411E	1.982	5.951	.1650

TABLE 11

Dielectric Constant, Density

and Capacity Index at 32°F(0°C)

Grade JP-1 Fuels

Specimen Number	Dielectric Constant at 400 Cps	Density Pounds per Gallon	Capacity Index (K-1)/D
221	2.161	6.872	.1690
221E	2.158	6.879	.1684
224	2.142	6.740	.1695
224E	2.148	6.751	.1701
229	2.187	6.969	.1704
229E	2.196	6.988	.1712
233	2.123	6.687	.1680
233E	2.119	6.699	.1671
241	2.120	6.648	.1685
241E	2.119	6.655	.1681
249	2.137	6.826	.1666
249E	2.128	6.840	.1649
259	2.122	6.646	.1688
259E	2.121	6.656	.1684
264	2.179	6.926	.1702
264E	2.182	6.943	.1702
268	2.131	6.670	.1696
268E	2.130	6.676	.1691
276	2.092	6.683	.1634

TABLE 11

(Continued)

Specimen Number	Dielectric Constant at 400 Cps	Density Pounds per Gallon	Capacity Index (K-1)/D
276E	2.129	6.690	.1688
287	2.150	6.815	.1687
287E	2.156	6.820	.1695
290	2.174	6.936	.1693
290E	2.180	6.953	.1697
293	2.134	6.706	.1691
293E	2.136	6.712	.1692
294	2.180	6.948	.1698
294E	2.185	6.966	.1701
306	2.127	6.722	.1677
306E	2.119	6.733	.1662
312	2.145	6.707	.1707
312E	2.137	6.712	.1694
316	2.192	6.991	.1705
316E	2.184	7.018	.1687
318	2.107	6.661	.1662
318E	2.110	6.763	.1641
322	2.187	6.977	.1701
322E	2.195	6.999	.1707
336	2.183	6.938	.1705

TABLE 11

(Continued)

Specimen Number	Dielectric Constant at 400 Cps	Density Pounds per Gallon	Capacity Index (K-1)/D
336E	2.186	6.955	.1705
344	2.144	6.872	.1681
344E	2.147	6.886	.1666
357	2.166	6.896	.1691
357E	2.170	6.918	.1691
364	2.182	6.915	.1709
364E	2.185	6.926	.1711
377	2.189	6.920	.1708
377E	2.179	6.945	.1698

TABLE 12

Dielectric Constant, Density

and Capacity Index at 32°F(0°C)

Grade JP-3 Fuels

Specimen Number	Dielectric Constant at 400 Cps	Density Pounds per Gallon	Capacity Index (K-1)/D
203	2.029	6.242	.1649
203E	2.053	6.303	.1671
209	2.143	6.827	.1674
209E	2.160	6.956	.1668
211	2.010	6.176	.1635
211E	2.037	6.279	.1652
222	2.118	6.595	.1695
222E	2.159	6.743	.1719
228	2.135	6.630	.1712
228E	2.167	6.736	.1733
232	2.074	6.431	.1670
232E	2.096	6.545	.1675
234	2.042	6.335	.1645
234E	2.061	6.418	.1653
248	2.127	6.666	.1691
248E	2.159	6.810	.1702
254	2.051	6.368	.1650
254E	2.071	6.450	.1660
262	2.146	6.629	.1729

TABLE 12

(Continued)

Specimen Number	Dielectric Constant at 400 Cps	Density Pounds per Gallon	Capacity Index (K-1)/D
262E	2.175	6.724	.1747
277	2.058	6.327	.1672
277E	2.069	6.405	.1669
283	2.098	6.531	.1681
283E	2.109	6.630	.1673
302	2.095	6.478	.1690
302E	2.104	6.592	.1675
311	2.136	6.636	.1712
311E	2.161	6.774	.1714
315	2.141	6.737	.1694
315E	2.158	6.882	.1683
317	2.103	6.618	.1667
317E	2.141	6.778	.1683
325	2.152	6.771	.1701
325E	2.175	6.928	.1696
337	2.073	6.415	.1673
337E	2.100	6.517	.1688
338	2.045	6.388	.1636
338E	2.076	6.495	.1657
345	2.109	6.580	.1685
345E	2.112	6.694	.1661

TABLE 12

(Continued)

Specimen Number	Dielectric Constant at 400 Cps	Density Pounds per Gallon	Capacity Index (K-1)/D
347	2.101	6.565	.1664
347E	2.139	6.696	.1701
359	2.054	6.346	.1661
359E	2.072	6.431	.1667
360	2.036	6.180	.1676
360E	2.059	6.380	.1660
361	2.119	6.681	.1675
361E	2.153	6.803	.1695
369	2.099	6.554	.1677
369E	2.125	6.690	.1682
372	2.033	6.286	.1643
372E	2.060	6.373	.1663
375	2.065	6.393	.1666
375E	2.086	6.522	.1665
385	2.138	6.763	.1683
385E	2.157	6.963	.1662
391	2.108	6.459	.1715
391E	2.132	6.580	.1720
394	2.048	6.283	.1668
394E	2.062	6.384	.1664
397	2.049	6.304	.1664

TABLE 12

(Continued)

Specimen Number	Dielectric Constant at 400 Cps	Density Pounds per Gallon	Capacity Index (K-1)/D
397E	2.065	6.400	.1664
403	2.120	6.640	.1687
403E	2.132	6.790	.1667
407	2.039	6.317	.1645
407E	2.055	6.369	.1656
410	2.127	6.700	.1682
410E	2.155	6.799	.1699
416	2.036	6.273	.1652
416E	2.050	6.398	.1641

TABLE 13

Dielectric Constant, Density

and Capacity Index at 32°F(0°C)

Grade JP-4 Fuels

Specimen Number		Dielectric Constant at 400 Cps	Density Pounds per Gallon	Capacity Index (K-1)/D
415	MLF 5411	2.051	6.347	.1656
415E		2.064	6.398	.1663
417	MLF 5477	2.076	6.517	.1651
417E		2.090	6.588	.1655
418	MLF 5478	2.095	6.585	.1663
418E		2.106	6.645	.1664
419	MLF 5484	2.062	6.434	.1651
419E		2.082	6.493	.1666
420	MLF 5494	2.050	6.349	.1654
420E		2.052	6.399	.1644
421	MLF 5541	2.077	6.503	.1656
421E		2.088	6.569	.1656

TABLE 14

Dielectric Constant, Density

and Capacity Index at 32°F(0°C)

Special Fuels

Specimen Number		Dielectric Constant at 400 Cps	Density Pounds per Gallon	Capacity Index (K-1)/D
296	Turbo Fuel No. 3	2.174	6.619	.1774
296E	(WS- 2006)	2.220	6.753	.1807
380	MLF 4890	2.052	6.245	.1685
380E		2.064	6.318	.1684
381	MLF 5209	2.041	6.300	.1652
381E		2.058	6.371	.1661
382	MLF 4891	2.333	6.242	.2136
382E		2.297	6.317	.2053
383	MLF 4889	2.044	6.239	.1673
383E		2.049	6.295	.1666

TABLE 15

Mean, Maximum, and Minimum Values at 32°F(0°C)

Unevaporated Specimens

Grade	Number of Specimens	Dielectric Constant			Density - Lb/Gallon			Capacity Index		
		Mean	Max	Min	Mean	Max	Min	Mean	Max	Min
91/98	55	1.988	2.038	1.962	6.028	6.237	5.896	.1639	.1680	.1614
100/130	51	1.985	2.048	1.950	5.979	6.169	5.842	.1647	.1699	.1605
115/145	44	1.969	2.007	1.947	5.903	6.041	5.836	.1642	.1680	.1602
JP-1	24	2.152	2.192	2.092	6.820	6.991	6.646	.1690	.1709	.1634
JP-3	35	2.087	2.152	2.010	6.489	6.827	6.176	.1675	.1729	.1635
JP-4	6	2.069	2.095	2.050	6.456	6.585	6.347	.1655	.1663	.1651
100/130 + 115/145	51 + 44	1.978	2.048	1.947	5.944	6.169	5.836	.1645	.1699	.1615
100/130 + 115/145 + JP-3	51 + 44 + 35	2.007	2.152	1.947	6.091	6.827	5.836	.1653	.1729	.1615

TABLE 16

Mean, Maximum, and Minimum Values at 32°F(0°C)

Evaporated Specimens

Grade	Number of Specimens	Dielectric Constant Mean	Dielectric Constant Max	Dielectric Constant Min	Density - Lb/Gallon Mean	Density - Lb/Gallon Max	Density - Lb/Gallon Min	Capacity Index Mean	Capacity Index Max	Capacity Index Min
91/98	55	1.998	2.051	1.970	6.079	6.297	5.941	.1641	.1690	.1608
100/130	51	1.997	2.066	1.960	6.036	6.249	5.879	.1651	.1706	.1613
115/145	44	1.980	2.024	1.963	5.958	6.104	5.864	.1645	.1678	.1613
JP-1	24	2.154	2.196	2.110	6.837	7.018	6.655	.1688	.1712	.1641
JP-3	35	2.110	2.175	2.037	6.607	6.963	6.279	.1680	.1747	.1652
JP-4	6	2.080	2.106	2.052	6.515	6.645	6.398	.1658	.1666	.1644
100/130	51	1.989	2.066	1.960	6.000	6.249	5.864	.1648	.1706	.1613
115/145	44									
100/130	51	2.021	2.175	1.960	6.163	6.963	5.864	.1657	.1747	.1613
115/145	44									
JP-3	35									

TABLE 17

Effect of Evaporation of 10% by Volume

At 32°F(0°C)

Fuel Grade	No. of Samples	Dielectric Constant			Density			Capacity Index		
		Mean Un-evaporated	Mean Evaporated	Per Cent Increase	Mean Un-evaporated	Mean Evaporated	Per Cent Increase	Mean Un-evaporated	Mean Evaporated	Per Cent Increase
91/98	55	1.988	1.998	.50	6.028	6.079	.85	.1639	.1641	.12
100/130	51	1.985	1.997	.60	5.979	6.036	.95	.1647	.1651	.24
115/145	44	1.969	1.980	.56	5.903	5.958	.93	.1642	.1645	.18
JP-1	24	2.152	2.154	.09	6.820	6.837	.25	.1690	.1688	-.12
Jp-3	35	2.087	2.110	1.10	6.489	6.607	1.82	.1675	.1680	.30
JP-4	6	2.069	2.080	.53	6.456	6.515	.91	.1655	.1658	.18

TABLE 18

Dissipation Factor at 400 Cycles Per Second

Specimen Number	Grade	Temperature, Degrees F					
		-65(-54°C)	-40(-40°C)	-4(-20°C)	32(0°C)	77(25°C)	130(54°C)
381	Special	.0039	.0053	.0083	.0119	.0174	.0198
381E		.0101	.0153	.0202	.0228	.0325	.0391
382	Special	.0000	.0003	.0017	.0025	.0037	.0068
382E		.0003	.0008	.0021	.0027	.0041	.0074

TABLE 19

Slope of Density vs. Temperature Curves

As a Function of Density

Specimen Number	Grade	Density at 32°F Pounds per Gallon	Change in Density per Deg F Pounds per Gallon x 10^4
157	100/130	5.924	39.85
158	100/130	6.008	39.28
159	JP-1	6.898	33.95
159E		6.917	34.15
160	JP-3	6.699	35.44
160E		6.855	34.67
162	100/130	5.919	39.79
163	115/145	5.928	39.95
164	100/130	5.954	39.23
164E		5.976	39.95
165	115/145	5.958	39.44
165E		6.029	39.08
208	115/145	5.908	39.18
209	JP-3	6.827	35.90
210	100/130	6.076	38.97
219	91/98	6.188	41.79
223	91/98	5.972	41.38
233	JP-1	6.687	33.85
236	115/145	5.918	38.62

TABLE 19

(Continued)

Specimen Number	Grade	Density at 32°F Pounds per Gallon	Change in Density per Deg F Pounds per Gallon x 10^4
237	100/130	5.944	37.70
240	100/130	5.891	38.56
241	JP-1	6.648	34.87
248	JP-3	6.666	35.49
256	91/98	5.959	39.13
260	115/145	5.927	38.67
264	JP-1	6.926	33.69
273	91/98	5.930	38.97
277	JP-3	6.327	37.74
281	115/145	5.902	38.72
283	JP-3	6.531	36.92
285	100/130	5.884	38.67
290	JP-1	6.936	34.46
300	100/130	6.075	38.62
307	91/98	6.070	38.67
309	91/98	5.922	38.36
313	115/145	5.909	38.26

TABLE 20

Mean Temperature Coefficients

of Dielectric Constant

Grade		Mean Slope of Dielectric Constant vs. Temperature Curves Per Degree F	Mean Dielectric Constant at 32°F(0°C), 400 Cps	Mean Temperature Coefficient of Dielectric Constant	
				Per Degree F	Per Degree C
91/98	Unevaporated	.00077	1.988	.00039	.00070
	Evaporated	.00078	1.998	.00039	.00070
100/130	Unevaporated	.00079	1.985	.00040	.00072
	Evaporated	.00078	1.997	.00039	.00070
115/145	Unevaporated	.00076	1.969	.00039	.00070
	Evaporated	.00075	1.980	.00038	.00068
JP-1	Unevaporated	.00078	2.152	.00036	.00065
	Evaporated	.00077	2.154	.00036	.00065
JP-3	Unevaporated	.00079	2.087	.00038	.00068
	Evaporated	.00078	2.110	.00037	.00067

TABLE 21

Dielectric Constant and Density

at -65°F(-54°C), 32°F(0°C), and 130°F(54°C)

Grade 91/98 Fuels

Specimen Number	Dielectric Constant at 400 Cps			Density - Pounds per Gallon		
	-65°F(-54°C)	32°F(0°C)	130°F(54°C)	-65°F(-54°C)	32°F(0°C)	130°F(54°C)
200	2.075	1.999	1.923	6.482	6.109	5.732
200E	2.083	2.007	1.930	6.555	6.186	5.813
201	2.044	1.970	1.895	6.310	5.928	5.543
201E	2.050	1.975	1.900	6.359	5.980	5.597
204	2.062	1.987	1.911	6.349	5.970	5.587
204E	2.074	1.998	1.922	6.395	6.018	5.637
205	2.043	1.969	1.894	6.291	5.909	5.523
205E	2.053	1.978	1.902	6.382	6.004	5.622
215	2.047	1.972	1.897	6.320	5.939	5.554
215E	2.060	1.985	1.909	6.386	6.008	5.626
216	2.038	1.964	1.889	6.315	5.934	5.549
216E	2.058	1.983	1.907	6.373	5.995	5.613
217	2.047	1.972	1.897	6.341	5.961	5.577
217E	2.062	1.987	1.911	6.406	6.029	5.649
*-219	2.083	2.000	1.928	6.594	6.188	5.779*
* 219E	2.089	2.018	1.935	6.644	6.239	5.834*
* 223	2.050	1.968	1.891	6.376	5.972	5.569*
* 223E	2.062	1.987	1.908	6.411	6.003	5.608
227	2.089	2.013	1.936	6.603	6.237	5.867

TABLE 21

(Continued)

Specimen Number	Dielectric Constant at 400 Cps			Density - Pounds per Gallon		
	-65°F(-54°C)	32°F(0°C)	130°F(54°C)	-65°F(-54°C)	32°F(0°C)	130°F(54°C)
227E	2.109	2.032	1.954	6.660	6.297	5.930
235	2.054	1.979	1.903	6.370	5.992	5.610
235E	2.064	1.989	1.913	6.421	6.045	5.665
238	2.048	1.973	1.898	6.331	5.951	5.567
238E	2.054	1.979	1.903	6.372	5.994	5.612
239	2.040	1.966	1.891	6.330	5.950	5.566
239E	2.046	1.971	1.896	6.379	6.001	5.619
242	2.042	1.968	1.893	6.353	5.974	5.592
242E	2.051	1.976	1.901	6.382	6.004	5.622
247	2.056	1.981	1.905	6.363	5.984	5.601
247E	2.054	1.979	1.903	6.403	6.026	5.645
252	2.084	2.008	1.931	6.426	6.050	5.671
252E	2.094	2.018	1.941	6.468	6.095	5.718
253	2.072	1.997	1.921	6.484	6.112	5.736
253E	2.077	2.001	1.925	6.548	6.179	5.806
* 256	2.037	1.969	1.896	6.339	5.959	5.576*
* 256E	2.062	1.984	1.907	6.393	6.011	5.629*
261	2.057	1.982	1.906	6.426	6.050	5.671
261E	2.070	1.995	1.919	6.464	6.090	5.713
265	2.044	1.970	1.895	6.339	5.959	5.575
265E	2.052	1.977	1.901	6.381	6.003	5.621

TABLE 21

(Continued)

Specimen Number	Dielectric Constant at 400 Cps			Density - Pounds per Gallon		
	-65°F(-54°C)	32°F(0°C)	130°F(54°C)	-65°F(-54°C)	32°F(0°C)	130°F(54°C)
269	2.071	1.996	1.920	6.440	6.065	5.686
269E	2.087	2.011	1.934	6.468	6.095	5.718
270	2.043	1.969	1.894	6.354	5.975	5.592
270E	2.059	1.984	1.908	6.387	6.010	5.629
* 273	2.046	1.975	1.906	6.309	5.930	5.549*
* 273E	2.055	1.986	1.909	6.349	5.970	5.587*
280	2.055	1.980	1.904	6.380	6.002	5.620
280E	2.056	1.981	1.905	6.409	6.033	5.653
286	2.086	2.010	1.933	6.547	6.178	5.805
286E	2.101	2.024	1.947	6.618	6.252	5.883
288	2.083	2.007	1.930	6.425	6.049	5.670
288E	2.086	2.010	1.933	6.466	6.093	5.716
298	2.049	1.974	1.899	6.301	5.919	5.533
298E	2.068	1.993	1.917	6.346	5.966	5.582
299	2.086	2.010	1.933	6.463	6.089	5.711
299E	2.094	2.018	1.941	6.514	6.143	5.768
303	2.048	1.973	1.898	6.347	5.967	5.583
303E	2.047	1.972	1.897	6.385	6.007	5.625
* 307	2.095	2.008	1.944	6.444	6.070	5.690*
* 307E	2.077	1.993	1.926	6.476	6.100	5.725*
* 309	2.047	1.976	1.903	6.291	5.922	5.543*

TABLE 21

(Continued)

Specimen Number	Dielectric Constant at 400 Cps			Density - Pounds per Gallon		
	-65°F(-54°C)	32°F(0°C)	130°F(54°C)	-65°F(-54°C)	32°F(0°C)	130°F(54°C)
* 309E	2.060	1.985	1.918	6.341	5.963	5.584
310	2.059	1.984	1.908	6.427	6.052	5.673
310E	2.058	1.983	1.907	6.470	6.097	5.720
323	2.054	1.979	1.903	6.312	5.931	5.546
323E	2.060	1.985	1.909	6.355	5.976	5.593
* 326	2.089	2.002	1.942	6.499	6.111	5.723*
* 326E	2.088	2.004	1.942	6.559	6.169	5.781*
328	2.091	2.015	1.938	6.484	6.112	5.736
328E	2.106	2.029	1.951	6.540	6.170	5.797
332	2.048	1.973	1.898	6.339	5.959	5.575
332E	2.053	1.978	1.902	6.375	5.997	5.615
335	2.084	2.008	1.931	6.498	6.126	5.750
335E	2.095	2.019	1.942	6.550	6.181	5.808
340	2.055	1.980	1.904	6.320	5.939	5.554
340E	2.058	1.983	1.907	6.368	5.989	5.607
346	2.050	1.975	1.900	6.310	5.929	5.544
346E	2.044	1.970	1.895	6.356	5.977	5.594
349	2.089	2.013	1.936	6.574	6.206	5.834
349E	2.129	2.051	1.973	6.627	6.262	5.893
* 352	2.104	2.027	1.955	6.534	6.163	5.783*
* 352E	2.139	2.050	1.974	6.585	6.213	5.832*

TABLE 21

(Continued)

Specimen Number	Dielectric Constant at 400 Cps			Density - Pounds per Gallon		
	-65°F(-54°C)	32°F(0°C)	130°F(54°C)	-65°F(-54°C)	32°F(0°C)	130°F(54°C)
354	2.048	1.973	1.898	6.312	5.931	5.546
354E	2.058	1.983	1.907	6.362	5.983	5.600
362	2.051	1.976	1.901	6.422	6.046	5.666
362E	2.055	1.980	1.904	6.459	6.085	5.707
363	2.067	1.992	1.916	6.509	6.138	5.763
363E	2.081	2.005	1.928	6.578	6.210	5.838
* 365	2.079	1.968	1.918	6.327	5.946	5.558*
* 365E	2.051	1.994	1.898	6.426	6.044	5.650*
371	2.107	2.030	1.952	6.530	6.160	5.786
371E	2.124	2.047	1.969	6.585	6.218	5.847
373	2.092	2.016	1.939	6.492	6.120	5.744
373E	2.105	2.028	1.951	6.553	6.184	5.811
387	2.056	1.981	1.905	6.420	6.044	5.664
387E	2.066	1.991	1.915	6.464	6.090	5.713
392	2.036	1.962	1.887	6.279	5.896	5.509
392E	2.047	1.972	1.897	6.322	5.941	5.556
396	2.046	1.971	1.896	6.302	5.920	5.534
396E	2.053	1.978	1.902	6.350	5.971	5.588
398	2.115	2.038	1.960	6.546	6.177	5.804
398E	2.127	2.050	1.972	6.606	6.240	5.870
* 400	2.085	1.997	1.941	6.549	6.153	5.761*

TABLE 21

(Continued)

Specimen Number	Dielectric Constant at 400 Cps			Density - Pounds per Gallon		
	-65°F(-54°C)	32°F(0°C)	130°F(54°C)	-65°F(-54°C)	32°F(0°C)	130°F(54°C)
* 400E	2.074	1.997	1.923	6.591	6.199	5.807
406	2.063	1.988	1.912	6.441	6.066	5.687
406E	2.081	2.005	1.928	6.467	6.094	5.717
412	2.058	1.983	1.907	6.393	6.061	5.682
412E	2.064	1.989	1.913	6.469	6.096	5.719
414	2.086	2.010	1.933	6.461	6.087	5.709
414E	2.098	2.022	1.945	6.517	6.146	6.055

TABLE 22

Dielectric Constant and Density

at -65°F(-54°C), 32°F(0°C), and 130°F(54°C)

Grade 100/130 Fuels

Specimen Number	Dielectric Constant at 400 Cps			Density - Pounds per Gallon		
	-65°F(-54°C)	32°F(0°C)	130°F(54°C)	-65°F(-54°C)	32°F(0°C)	130°F(54°C)
202	2.027	1.951	1.875	6.272	5.889	5.502
202E	2.046	1.971	1.896	6.336	5.956	5.572
207	2.085	2.007	1.928	6.409	6.033	5.653
207E	2.087	2.011	1.934	6.484	6.111	5.735
* 210	2.098	2.015	1.934	6.450	6.076	5.683*
* 210E	2.091	2.021	1.946	6.520	6.132	5.738*
213	2.035	1.959	1.882	6.272	5.889	5.502
213E	2.041	1.967	1.892	6.331	5.951	5.567
214	2.062	1.985	1.907	6.333	5.953	5.569
214E	2.067	1.992	1.916	6.398	6.021	5.640
220	2.097	2.019	1.940	6.490	6.118	5.742
220E	2.102	2.025	1.948	6.546	6.177	5.804
225	2.049	1.972	1.895	6.396	6.019	5.638
225E	2.063	1.988	1.912	6.445	6.070	5.692
230	2.047	1.971	1.894	6.252	5.867	5.478
230E	2.046	1.971	1.896	6.326	5.945	5.560
* 237	2.041	1.967	1.887	6.312	5.944	5.577*
* 237E	2.049	1.977	1.904	6.369	5.994	5.623*
* 240	2.029	1.953	1.886	6.266	5.891	5.514*

TABLE 22

(Continued)

Specimen Number	Dielectric Constant at 400 Cps			Density - Pounds per Gallon		
	-65°F(-54°C)	32°F(0°C)	130°F(54°C)	-65°F(-54°C)	32°F(0°C)	130°F(54°C)
* 240E	2.044	1.978	1.898	6.325	5.949	5.568*
243	2.036	1.960	1.883	6.275	5.892	5.505
243E	2.036	1.962	1.887	6.344	5.964	5.580
245	2.032	1.956	1.880	6.228	5.842	5.452
245E	2.034	1.960	1.885	6.263	5.879	5.491
250	2.043	1.967	1.890	6.237	5.852	5.463
250E	2.085	2.009	1.932	6.314	5.933	5.548
255	2.038	1.962	1.885	6.276	5.893	5.506
255E	2.039	1.965	1.890	6.322	5.941	5.556
258	2.044	1.968	1.891	6.327	5.946	5.561
258E	2.055	1.980	1.904	6.378	6.000	5.618
263	2.037	1.961	1.884	6.297	5.915	5.529
263E	2.055	1.980	1.904	6.349	5.969	5.586
267	2.035	1.959	1.882	6.282	5.899	5.512
267E	2.041	1.967	1.892	6.317	5.936	5.551
271	2.050	1.973	1.896	6.278	5.895	5.508
271E	2.052	1.977	1.902	6.323	5.942	5.557
272	2.107	2.028	1.949	6.512	6.141	5.766
272E	2.124	2.047	1.969	6.576	6.208	5.836
275	2.053	1.976	1.899	6.340	5.959	5.575
275E	2.059	1.984	1.908	6.363	5.984	5.601

TABLE 22

(Continued)

Specimen Number	Dielectric Constant at 400 Cps			Density - Pounds per Gallon		
	-65°F(-54°C)	32°F(0°C)	130°F(54°C)	-65°F(-54°C)	32°F(0°C)	130°F(54°C)
279	2.046	1.970	1.893	6.312	5.931	5.546
279E	2.058	1.983	1.907	6.345	5.965	5.581
* 285	2.058	1.977	1.915	6.260	5.884	5.506*
* 285E	2.050	1.975	1.913	6.303	5.931	5.552*
289	2.049	1.972	1.895	6.349	5.969	5.586
289E	2.047	1.972	1.897	6.383	6.005	5.623
291	2.036	1.960	1.883	6.304	5.922	5.536
291E	2.051	1.976	1.901	6.346	5.966	5.582
297	2.108	2.029	1.949	6.508	6.137	5.762
297E	2.112	2.035	1.957	6.550	6.181	5.808
* 300	2.099	2.016	1.950	6.451	6.075	5.698*
* 300E	2.123	2.038	1.965	6.521	6.146	5.768*
304	2.042	1.966	1.889	6.279	5.896	5.509
304E	2.048	1.973	1.898	6.341	5.961	5.577
314	2.045	1.969	1.892	6.277	5.894	5.507
314E	2.041	1.967	1.892	6.329	5.948	5.564
319	2.093	2.015	1.936	6.466	6.093	5.716
319E	2.126	2.049	1.971	6.536	6.166	5.792
321	2.056	1.979	1.901	6.330	5.950	5.566
321E	2.074	1.998	1.922	6.373	5.995	5.613
327	2.068	1.991	1.913	6.422	6.046	5.666
327E	2.081	2.005	1.928	6.488	6.116	5.740

TABLE 22

(Continued)

Specimen Number	Dielectric Constant at 400 Cps			Density - Pounds per Gallon		
	-65°F(-54°C)	32°F(0°C)	130°F(54°C)	-65°F(-54°C)	32°F(0°C)	130°F(54°C)
* 330	2.108	2.032	1.953	6.534	6.144	5.757*
* 330E	2.107	2.041	1.959	6.582	6.196	5.806*
331	2.040	1.964	1.887	6.272	5.889	5.502
331E	2.054	1.979	1.903	6.320	5.939	5.554
333	2.085	2.007	1.928	6.494	6.122	5.746
333E	2.102	2.025	1.948	6.550	6.181	5.808
339	2.062	1.985	1.907	6.330	5.950	5.566
339E	2.069	1.994	1.918	6.374	5.996	5.614
343	2.068	1.991	1.913	6.359	5.980	5.597
343E	2.076	2.000	1.924	6.410	6.033	5.653
350	2.038	1.962	1.885	6.247	5.862	5.473
350E	2.042	1.968	1.893	6.296	5.914	5.528
351	2.127	2.048	1.968	6.539	6.169	5.795
351E	2.144	2.066	1.987	6.615	6.249	5.879
356	2.044	1.968	1.891	6.276	5.893	5.506
356E	2.043	1.969	1.894	6.328	5.947	5.562
358	2.040	1.964	1.887	6.283	5.900	5.513
358E	2.041	1.967	1.892	6.319	5.938	5.553
* 367	2.104	2.008	1.942	6.520	6.128	5.734*
* 367E	2.124	2.044	1.968	6.618	6.228	5.835*
370	2.096	2.018	1.939	6.445	6.070	5.692
370E	2.114	2.037	1.959	6.506	6.135	5.760

TABLE 22

(Continued)

Specimen Number	Dielectric Constant at 400 Cps			Density - Pounds per Gallon		
	-65°F(-54°C)	32°F(0°C)	130°F(54°C)	-65°F(-54°C)	32°F(0°C)	130°F(54°C)
* 378	2.119	2.020	1.954	6.487	6.093	5.697*
* 378E	2.133	2.049	1.966	6.577	6.184	5.790*
386	2.044	1.968	1.891	6.303	5.921	5.535
386E	2.051	1.976	1.901	6.359	5.980	5.597
393	2.039	1.963	1.886	6.272	5.889	5.502
393E	2.056	1.981	1.905	6.358	5.979	5.596
395	2.081	2.003	1.924	6.403	6.026	5.645
395E	2.082	2.006	1.929	6.456	6.082	5.704
399	2.097	2.019	1.940	6.424	6.048	5.668
399E	2.088	2.012	1.935	6.481	6.108	5.731
* 401	2.023	1.950	1.874	6.302	5.919	5.529*
* 401E	2.031	1.969	1.891	6.352	5.965	5.580*
405	2.101	2.022	1.943	6.516	6.145	5.770
405E	2.116	2.039	1.961	6.560	6.191	5.819
409	2.042	1.966	1.889	6.338	5.958	5.574
409E	2.050	1.975	1.900	6.410	5.979	5.596
413	2.095	2.017	1.938	6.494	6.122	5.746
413E	2.110	2.033	1.955	6.544	6.175	5.802

TABLE 23

Dielectric Constant and Density

At -65°F(-54°C), 32°F(0°C), and 130°F(54°C)

Grade 115/145 Fuels

Specimen Number	Dielectric Constant at 400 Cps			Density - Pounds per Gallon		
	-65°F(-54°C)	32°F(0°C)	130°F(54°C)	-65°F(-54°C)	32°F(0°C)	130°F(54°C)
206	2.049	1.974	1.900	6.264	5.880	5.492
206E	2.048	1.975	1.902	6.379	6.001	5.619
* 208	2.039	1.962	1.890	6.289	5.908	5.525*
* 208E	2.037	1.972	1.900	6.342	5.959	5.575*
212	2.043	1.969	1.894	6.306	5.924	5.536
212E	2.056	1.983	1.909	6.373	5.995	5.613
218	2.040	1.966	1.891	6.353	5.974	5.591
218E	2.058	1.985	1.911	6.409	6.033	5.653
226	2.049	1.947	1.873	6.226	5.840	5.450
226E	2.040	1.967	1.894	6.268	5.884	5.496
231	2.043	1.969	1.894	6.272	5.889	5.502
231E	2.041	1.968	1.895	6.316	5.935	5.550
* 236	2.063	1.977	1.895	6.296	5.918	5.543*
* 236E	2.067	1.987	1.921	6.344	5.973	5.596*
244	2.046	1.971	1.896	6.264	5.880	5.492
244E	2.046	1.973	1.900	6.310	5.929	5.544
246	2.029	1.955	1.880	6.274	5.891	5.504
246E	2.052	1.979	1.905	6.321	5.940	5.555
251	2.062	1.987	1.911	6.348	5.968	5.584

TABLE 23

(Continued)

Specimen Number	Dielectric Constant at 400 Cps			Density - Pounds per Gallon		
	-65°F(-54°C)	32°F(0°C)	130°F(54°C)	-65°F(-54°C)	32°F(0°C)	130°F(54°C)
251E	2.078	2.004	1.930	6.408	6.032	5.652
257	2.066	1.991	1.915	6.281	5.898	5.511
257E	2.061	1.988	1.914	6.329	5.948	5.564
* 260	2.049	1.976	1.914	6.305	5.927	5.551*
* 260E	2.043	1.981	1.892	6.366	5.984	5.610*
266	2.029	1.955	1.880	6.239	5.854	5.465
266E	2.039	1.966	1.893	6.268	5.884	5.496
274	2.045	1.970	1.895	6.269	5.885	5.497
274E	2.052	1.979	1.905	6.352	5.973	5.590
278	2.043	1.969	1.894	6.305	5.923	5.537
278E	2.055	1.982	1.908	6.341	5.961	5.577
* 281	2.064	1.984	1.917	6.278	5.902	5.523*
* 281E	2.066	1.990	1.920	6.321	5.945	5.568*
282	2.026	1.952	1.877	6.269	5.855	5.466
282E	2.038	1.965	1.892	6.286	5.903	5.516
284	2.051	1.976	1.901	6.300	5.918	5.532
284E	2.046	1.973	1.900	6.344	5.964	5.580
292	2.042	1.968	1.893	6.307	5.925	5.539
292E	2.054	1.981	1.907	6.345	5.965	5.581
295	2.083	2.007	1.930	6.417	6.041	5.661
295E	2.097	2.024	1.949	6.477	6.104	5.727

TABLE 23

(Continued)

Specimen Number	Dielectric Constant at 400 Cps			Density - Pounds per Gallon		
	-65°F(-54°C)	32°F(0°C)	130°F(54°C)	-65°F(-54°C)	32°F(0°C)	130°F(54°C)
301	2.033	1.959	1.884	6.310	5.928	5.543
301E	2.072	1.998	1.924	6.350	5.971	5.588
305	2.052	1.977	1.901	6.282	5.899	5.512
305E	2.053	1.980	1.906	6.325	5.944	5.559
308	2.048	1.973	1.898	6.295	5.913	5.527
308E	2.068	1.994	1.920	6.349	5.969	5.586
* 313	2.042	1.965	1.903	6.277	5.909	5.531*
* 313E	2.055	1.984	1.915	6.347	5.971	5.592*
320	2.039	1.965	1.890	6.276	5.897	5.510
320E	2.043	1.970	1.897	6.390	6.013	5.632
324	2.041	1.967	1.892	6.285	5.902	5.515
324E	2.056	1.983	1.910	6.353	5.974	5.591
329	2.052	1.977	1.901	6.280	5.897	5.510
329E	2.071	1.997	1.923	6.325	5.944	5.559
* 334	2.045	1.964	1.895	6.238	5.862	5.483*
* 334E	2.033	1.964	1.899	6.290	5.910	5.534*
* 341	2.053	1.977	1.902	6.317	5.942	5.559*
* 341E	2.067	1.991	1.918	6.363	5.986	5.601*
* 342	2.024	1.966	1.878	6.274	5.899	5.518*
* 342E	2.031	1.969	1.888	6.326	5.947	5.566*
348	2.042	1.968	1.893	6.293	5.911	5.525
348E	2.044	1.971	1.898	6.342	5.962	5.578

TABLE 23

(Continued)

Specimen Number	Dielectric Constant at 400 Cps			Density - Pounds per Gallon		
	-65°F(-54°C)	32°F(0°C)	130°F(54°C)	-65°F(-54°C)	32°F(0°C)	130°F(54°C)
353	2.026	1.952	1.877	6.222	5.836	5.446
353E	2.035	1.963	1.890	6.262	5.878	5.490
355	2.033	1.959	1.884	6.233	5.848	5.459
355E	2.044	1.971	1.898	6.280	5.896	5.509
366	2.031	1.957	1.882	6.251	5.866	5.477
366E	2.046	1.973	1.900	6.302	5.920	5.534
368	2.038	1.964	1.889	6.309	5.927	5.541
368E	2.059	1.986	1.912	6.380	5.997	5.615
374	2.048	1.973	1.898	6.271	5.888	5.501
374E	2.054	1.981	1.907	6.325	5.944	5.559
376	2.062	1.987	1.911	6.273	5.890	5.503
376E	2.051	1.978	1.904	6.328	5.947	5.562
379	2.038	1.964	1.889	6.252	5.867	5.478
379E	2.047	1.974	1.901	6.310	5.929	5.544
389	2.036	1.962	1.887	6.238	5.853	5.464
389E	2.042	1.969	1.896	6.249	5.864	5.475
390	2.052	1.977	1.901	6.289	5.906	5.519
390E	2.058	1.985	1.911	6.344	5.964	5.580
* 402	2.043	1.967	1.898	6.278	5.894	5.504*
* 402E	2.037	1.967	1.895	6.327	5.942	5.553*
404	2.046	1.971	1.896	6.305	5.923	5.537
404E	2.060	1.986	1.912	6.367	5.988	5.605

TABLE 23

(Continued)

Specimen Number	Dielectric Constant at 400 Cps			Density - Pounds per Gallon		
	-65°F(-54°C)	32°F(0°C)	130°F(54°C)	-65°F(-54°C)	32°F(0°C)	130°F(54°C)
408	2.029	1.955	1.880	6.342	5.962	5.578
408E	2.051	1.978	1.904	6.398	6.021	5.640
411	2.055	1.980	1.904	6.277	5.894	5.507
411E	2.055	1.982	1.908	6.331	5.951	5.567

TABLE 24

Dielectric Constant and Density

at -65°F(-54°C), 32°F(0°C), and 130°F(54°C)

Grade JP-1 Fuels

Specimen Number	Dielectric Constant at 400 Cps			Density - Pounds per Gallon		
	-65°F(-54°C)	32°F(0°C)	130°F(54°C)	-65°F(-54°C)	32°F(0°C)	130°F(54°C)
221	2.236	2.161	2.085	7.207	6.872	6.533
221E	2.233	2.158	2.082	7.215	6.879	6.541
224	2.217	2.142	2.066	7.082	6.740	6.395
224E	2.223	2.148	2.072	7.092	6.751	6.406
229	2.263	2.187	2.110	7.299	6.969	6.635
229E	2.272	2.196	2.118	7.318	6.988	6.655
* 233	2.199	2.123	2.044	7.013	6.687	6.353*
* 233E	2.187	2.119	2.043	7.027	6.699	6.368*
* 241	2.205	2.120	2.036	6.987	6.648	6.307*
* 241E	2.188	2.119	2.033	6.996	6.655	6.314*
249	2.212	2.137	2.062	7.163	6.826	6.485
249E	2.202	2.128	2.053	7.178	6.840	6.500
259	2.196	2.122	2.047	6.992	6.646	6.296
259E	2.195	2.121	2.046	7.002	6.656	6.307
* 264	2.255	2.179	2.107	7.252	6.926	6.595*
* 264E	2.261	2.182	2.103	7.273	6.943	6.616*
268	2.205	2.131	2.056	7.015	6.670	6.321
268E	2.204	2.130	2.055	7.021	6.676	6.328
276	2.165	2.092	2.018	7.027	6.683	6.335

TABLE 24

(Continued)

Specimen Number	Dielectric Constant at 400 Cps			Density - Pounds per Gallon		
	-65°F(-54°C)	32°F(0°C)	130°F(54°C)	-65°F(-54°C)	32°F(0°C)	130°F(54°C)
276E	2.203	2.129	2.054	7.034	6.690	6.342
287	2.225	2.150	2.074	7.153	6.815	6.473
287E	2.231	2.156	2.080	7.158	6.820	6.479
* 290	2.253	2.174	2.101	7.271	6.936	6.599*
* 290E	2.263	2.180	2.109	7.286	6.953	6.615*
293	2.208	2.134	2.059	7.049	6.706	6.359
293E	2.211	2.136	2.060	7.056	6.712	6.365
294	2.256	2.180	2.103	7.280	6.948	6.613
294E	2.261	2.185	2.108	7.298	6.966	6.632
306	2.201	2.127	2.052	7.066	6.722	6.376
306E	2.193	2.119	2.044	7.076	6.733	6.387
312	2.220	2.145	2.069	7.051	6.707	6.360
312E	2.212	2.137	2.062	7.056	6.712	6.365
316	2.269	2.192	2.115	7.320	6.991	6.658
316E	2.260	2.184	2.107	7.346	7.018	6.687
318	2.181	2.107	2.033	7.007	6.661	6.312
318E	2.184	2.110	2.036	7.104	6.763	6.419
322	2.263	2.187	2.110	7.307	6.977	6.643
322E	2.272	2.195	2.118	7.328	6.999	6.667
* 336	2.270	2.183	2.108	7.265	6.938	6.603*
* 336E	2.274	2.186	2.121	7.288	6.955	6.628*

TABLE 24

(Continued)

Specimen Number	Dielectric Constant at 400 Cps			Density - Pounds per Gallon		
	-65°F(-54°C)	32°F(0°C)	130°F(54°C)	-65°F(-54°C)	32°F(0°C)	130°F(54°C)
344	2.219	2.144	2.068	7.207	6.872	6.533
344E	2.222	2.147	2.071	7.221	6.886	6.548
357	2.242	2.166	2.090	7.230	6.896	6.558
357E	2.246	2.170	2.093	7.251	6.918	6.582
* 364	2.269	2.182	2.108	7.241	6.915	6.587*
* 364E	2.265	2.185	2.112	7.254	6.926	6.601*
377	2.265	2.189	2.112	7.253	6.920	6.584
377E	2.255	2.179	2.102	7.277	6.945	6.610

TABLE 25

Dielectric Constant and Density

at -65°F(-54°C), 32°F(0°C), and 130°F(54°C)

Grade JP-3 Fuels

Specimen Number	Dielectric Constant at 400 Cps			Density - Pounds per Gallon		
	-65°F(-54°C)	32°F(0°C)	130°F(54°C)	-65°F(-54°C)	32°F(0°C)	130°F(54°C)
203	2.104	2.029	1.954	6.608	6.242	5.872
203E	2.127	2.053	1.978	6.667	6.303	5.936
* 209	2.235	2.143	2.069	7.178	6.827	6.477*
* 209E	2.227	2.160	2.089	7.301	6.956	6.609*
211	2.084	2.010	1.935	6.545	6.176	5.803
211E	2.110	2.037	1.963	6.653	6.279	5.911
222	2.196	2.118	2.039	6.944	6.595	6.243
222E	2.237	2.159	2.081	7.085	6.743	6.398
228	2.214	2.135	2.056	6.977	6.630	6.279
228E	2.245	2.167	2.088	7.078	6.736	6.391
232	2.151	2.074	1.997	6.788	6.431	6.070
232E	2.171	2.096	2.020	6.896	6.545	6.190
234	2.117	2.042	1.966	6.697	6.335	5.970
234E	2.135	2.061	1.986	6.775	6.418	6.057
* 248	2.218	2.127	2.052	7.011	6.666	6.319*
* 248E	2.247	2.159	2.089	7.150	6.810	6.466*
254	2.127	2.051	1.975	6.728	6.368	6.004
254E	2.145	2.071	1.996	6.806	6.450	6.090
262	2.225	2.146	2.066	6.976	6.629	6.278

TABLE 25

(Continued)

Specimen Number	Dielectric Constant at 400 Cps			Density - Pounds per Gallon		
	-65°F(-54°C)	32°F(0°C)	130°F(54°C)	-65°F(-54°C)	32°F(0°C)	130°F(54°C)
262E	2.253	2.175	2.096	7.066	6.724	6.378
* 277	2.132	2.058	1.989	6.697	6.327	5.961*
* 277E	2.145	2.069	1.994	6.775	6.405	6.036*
* 283	2.169	2.098	2.030	6.892	6.531	6.172*
* 283E	2.180	2.109	2.046	6.993	6.630	6.275*
302	2.172	2.095	2.017	6.833	6.478	6.120
302E	2.180	2.104	2.028	6.941	6.592	6.239
311	2.215	2.136	2.057	6.983	6.636	6.286
311E	2.239	2.161	2.083	7.114	6.774	6.430
315	2.220	2.141	2.061	7.079	6.737	6.392
315E	2.235	2.158	2.080	7.217	6.882	6.544
317	2.181	2.103	2.025	6.966	6.618	6.267
317E	2.218	2.141	2.063	7.118	6.778	6.435
325	2.231	2.152	2.072	7.111	6.771	6.427
325E	2.253	2.175	2.096	7.260	6.928	6.592
337	2.149	2.073	1.996	6.773	6.415	6.054
337E	2.175	2.100	2.024	6.870	6.517	6.161
338	2.120	2.045	1.969	6.747	6.388	6.025
338E	2.151	2.076	2.001	6.849	6.495	6.138
345	2.187	2.109	2.030	6.930	6.580	6.227
345E	2.188	2.112	2.035	7.038	6.694	6.346

TABLE 25

(Continued)

Specimen Number	Dielectric Constant at 400 Cps			Density - Pounds per Gallon		
	-65°F(-54°C)	32°F(0°C)	130°F(54°C)	-65°F(-54°C)	32°F(0°C)	130°F(54°C)
347	2.179	2.101	2.023	6.915	6.565	6.211
347E	2.216	2.139	2.061	7.040	6.696	6.349
* 359	2.133	2.054	1.994	6.718	6.346	5.971*
* 359E	2.154	2.072	1.999	6.803	6.431	6.059*
360	2.111	2.036	1.960	6.549	6.180	5.807
360E	2.133	2.059	1.984	6.739	6.380	6.017
361	2.197	2.119	2.040	7.026	6.681	6.333
361E	2.230	2.153	2.075	7.142	6.803	6.461
369	2.176	2.099	2.021	6.905	6.554	6.200
369E	2.201	2.125	2.048	7.034	6.690	6.342
372	2.108	2.033	1.957	6.650	6.286	5.918
372E	2.134	2.060	1.985	6.733	6.373	6.010
375	2.141	2.065	1.988	6.752	6.393	6.031
375E	2.161	2.086	2.010	6.874	6.522	6.166
385	2.216	2.138	2.058	7.104	6.763	6.419
385E	2.234	2.157	2.079	7.294	6.963	6.629
391	2.186	2.108	2.030	6.814	6.459	6.100
391E	2.209	2.132	2.055	6.930	6.580	6.227
394	2.124	2.048	1.972	6.647	6.283	5.915
394E	2.136	2.062	1.987	6.743	6.384	6.021
397	2.125	2.049	1.972	6.667	6.304	5.937
397E	2.139	2.065	1.990	6.758	6.400	6.038

TABLE 25

(Continued)

Specimen Number	Dielectric Constant at 400 Cps			Density - Pounds per Gallon		
	-65°F(-54°C)	32°F(0°C)	130°F(54°C)	-65°F(-54°C)	32°F(0°C)	130°F(54°C)
* 403	2.210	2.120	2.042	6.982	6.640	6.278*
* 403E	2.212	2.132	2.053	7.129	6.790	6.394*
407	2.114	2.039	1.963	6.679	6.317	5.951
407E	2.129	2.055	1.980	6.755	6.369	6.005
410	2.205	2.127	2.048	7.044	6.700	6.353
410E	2.232	2.155	2.077	7.138	6.799	6.457
416	2.111	2.036	1.960	6.638	6.273	5.905
416E	2.124	2.050	1.976	6.757	6.398	6.036

TABLE 26

Dielectric Constant and Density

at -65°F(-54°C), 32°F(0°C), and 130°F(54°C)

Grade JP-4 Fuels

Specimen Number		Dielectric Constant at 400 Cps			Density - Pounds per Gallon		
		-65°F(-54°C)	32°F(0°C)	130°F(54°C)	-65°F(-54°C)	32°F(0°C)	130°F(54°C)
415	MLF-5411	2.128	2.051	1.986	6.685	6.347	6.010
415E		2.141	2.064	1.994	6.735	6.398	6.060
417	MLF-5477	2.160	2.076	2.019	6.860	6.517	6.170
417E		2.165	2.090	2.017	6.933	6.588	6.245
418	MLF-5478	2.164	2.095	2.023	6.925	6.585	6.234
418E		2.182	2.106	2.033	6.993	6.645	6.303
419	MLF-5484	2.148	2.062	2.002	6.776	6.434	6.089
419E		2.182	2.082	2.028	6.835	6.493	6.148
420	MLF-5494	2.135	2.050	1.987	6.686	6.349	6.010
420E		2.141	2.052	1.984	6.735	6.399	6.060
421	MLF-5541	2.163	2.077	2.014	6.849	6.503	6.159
421E		2.176	2.088	2.023	6.910	6.569	6.220

TABLE 27

Capacity Index at

-65°F(-54°C), 32°F(0°C), and 130°F(54°C)

Grade 91/98 Fuel

Specimen Number	Capacity Index = (K - 1)/D		
	-65°F(-54°C)	32°F(0°C)	130°F(54°C)
200	.1658	.1635	.1610
200E	.1652	.1628	.1600
201	.1655	.1636	.1615
201E	.1651	.1630	.1608
204	.1673	.1653	.1631
204E	.1679	.1658	.1636
205	.1658	.1640	.1619
205E	.1650	.1629	.1604
215	.1657	.1637	.1615
215E	.1660	.1639	.1616
216	.1644	.1625	.1602
216E	.1660	.1640	.1616
217	.1651	.1631	.1608
217E	.1658	.1637	.1613
219	.1642	.1616	.1606
219E	.1639	.1632	.1603
223	.1647	.1621	.1600
223E	.1657	.1644	.1619
227	.1649	.1624	.1595

TABLE 27

(Continued)

Specimen Number	Capacity Index - (K - 1)/D		
	-65°F(-54°C)	32°F(0°C)	130°F(54°C)
227E	.1665	.1639	.1609
235	.1655	.1634	.1610
235E	.1657	.1636	.1612
238	.1655	.1635	.1613
238E	.1654	.1634	.1609
239	.1643	.1624	.1601
239E	.1640	.1618	.1595
242	.1640	.1620	.1597
242E	.1647	.1626	.1603
247	.1660	.1639	.1616
247E	.1646	.1625	.1600
252	.1687	.1666	.1642
252E	.1691	.1670	.1646
253	.1653	.1631	.1606
253E	.1645	.1620	.1593
256	.1636	.1626	.1607
256E	.1661	.1637	.1611
261	.1645	.1623	.1598
261E	.1655	.1634	.1609
265	.1647	.1628	.1605
265E	.1649	.1669	.1603
269	.1663	.1642	.1618

TABLE 27

(Continued)

Specimen Number	Capacity Index - (K - 1)/D		
	-65°F(-54°C)	32°F(0°C)	130°F(54°C)
269E	.1681	.1659	.1633
270	.1641	.1622	.1599
270E	.1658	.1637	.1613
273	.1658	.1644	.1633
273E	.1662	.1652	.1627
280	.1654	.1633	.1609
280E	.1648	.1626	.1601
286	.1659	.1635	.1607
286E	.1664	.1638	.1610
288	.1686	.1665	.1640
288E	.1680	.1658	.1632
298	.1665	.1646	.1624
298E	.1683	.1664	.1643
299	.1680	.1659	.1634
299E	.1679	.1657	.1631
303	.1651	.1631	.1608
303E	.1640	.1619	.1595
307	.1699	.1661	.1659
307E	.1663	.1628	.1617
309	.1664	.1648	.1629
309E	.1672	.1652	.1644

TABLE 27

(Continued)

Specimen Number	Capacity Index - (K - 1)/D		
	-65°F(-54°C)	32°F(0°C)	130°F(54°C)
310	.1648	.1626	.1601
310E	.1635	.1612	.1586
323	.1670	.1651	.1628
323E	.1668	.1683	.1625
326	.1676	.1640	.1646
326E	.1659	.1627	.1629
328	.1683	.1661	.1635
328E	.1691	.1668	.1641
332	.1653	.1633	.1611
332E	.1652	.1631	.1606
335	.1668	.1645	.1619
335E	.1672	.1649	.1622
340	.1669	.1650	.1628
340E	.1661	.1641	.1617
346	.1664	.1644	.1623
346E	.1643	.1623	.1600
349	.1657	.1644	.1604
349E	.1704	.1629	.1651
352	.1690	.1666	.1651
352E	.1730	.1690	.1670
354	.1660	.1641	.1619
354E	.1663	.1643	.1620

TABLE 27

(Continued)

Specimen Number	Capacity Index - (k - 1)/D		
	-65°F(-54°C)	32°F(0°C)	130°F(54°C)
362	.1637	.1614	.1590
362E	.1633	.1611	.1580
363	.1639	.1616	.1589
363E	.1643	.1618	.1590
365	.1705	.1628	.1652
365E	.1636	.1643	.1589
371	.1695	.1672	.1645
371E	.1707	.1684	.1657
373	.1682	.1660	.1635
373E	.1686	.1662	.1637
387	.1645	.1623	.1598
387E	.1649	.1627	.1602
392	.1650	.1632	.1610
392E	.1656	.1636	.1614
396	.1680	.1640	.1616
396E	.1658	.1638	.1614
398	.1703	.1680	.1654
398E	.1706	.1683	.1656
400	.1657	.1620	.1633
400E	.1629	.1608	.1589
406	.1650	.1629	.1604

TABLE 27

(Continued)

Specimen Number	Capacity Index - (K - 1)/D		
	-65°F(-54°C)	32°F(0°C)	130°F(54°C)
406E	.1672	.1649	.1623
412	.1655	.1622	.1596
412E	.1645	.1622	.1596
414	.1681	.1659	.1634
414E	.1685	.1663	.1561

TABLE 28

Capacity Index at

-65°F(-54°C), 32°F(0°C), and 130°F(54°C)

Grade 100/130 Fuel

Specimen Number	Capacity Index - (K - 1)/D		
	-65°F(-54°C)	32°F(0°C)	130°F(54°C)
202	.1637	.1615	.1590
202E	.1651	.1630	.1608
207	.1693	.1669	.1642
207E	.1676	.1654	.1629
210	.1702	.1671	.1643
210E	.1673	.1665	.1649
213	.1650	.1628	.1603
213E	.1644	.1625	.1602
214	.1677	.1655	.1629
214E	.1668	.1648	.1624
220	.1690	.1666	.1637
220E	.1683	.1660	.1633
225	.1640	.1615	.1587
225E	.1649	.1628	.1602
230	.1675	.1655	.1632
230E	.1653	.1634	.1612
237	.1649	.1627	.1590
237E	.1647	.1630	.1608
240	.1642	.1618	.1607

TABLE 28

(Continued)

Specimen Number	Capacity Index - (K - 1)/D		
	-65°F(-54°C)	32°F(0°C)	130°F(54°C)
240E	.1651	.1644	.1613
243	.1651	.1629	.1604
243E	.1633	.1613	.1590
245	.1657	.1636	.1614
245E	.1651	.1633	.1612
250	.1672	.1652	.1629
250E	.1718	.1701	.1680
255	.1654	.1632	.1607
255E	.1643	.1624	.1602
258	.1650	.1628	.1602
258E	.1654	.1633	.1609
263	.1647	.1625	.1599
263E	.1662	.1642	.1618
267	.1648	.1626	.1600
267E	.1648	.1629	.1607
271	.1673	.1651	.1627
271E	.1664	.1672	.1623
272	.1700	.1674	.1645
272E	.1709	.1686	.1660
275	.1661	.1638	.1613
275E	.1664	.1644	.1621
279	.1657	.1635	.1610

TABLE 28

(Continued)

Specimen Number	Capacity Index - (K - 1)/D		
	-65°F(-54°C)	32°F(0°C)	130°F(54°C)
279E	.1667	.1648	.1625
285	.1690	.1660	.1662
285E	.1666	.1644	.1644
289	.1652	.1628	.1602
289E	.1640	.1619	.1595
291	.1643	.1621	.1595
291E	.1656	.1636	.1614
297	.1703	.1677	.1647
297E	.1698	.1674	.1648
300	.1704	.1672	.1667
300E	.1722	.1689	.1673
304	.1659	.1638	.1614
304E	.1653	.1632	.1610
314	.1665	.1644	.1620
314E	.1645	.1626	.1603
319	.1690	.1666	.1638
319E	.1723	.1701	.1676
321	.1668	.1645	.1619
321E	.1685	.1665	.1643
327	.1663	.1639	.1611
327E	.1666	.1643	.1617
330	.1696	.1680	.1655

TABLE 28

(Continued)

Specimen Number	Capacity Index - (K - 1)/D		
	-65°F(-54°C)	32°F(0°C)	130°F(54°C)
330E	.1682	.1680	.1652
331	.1658	.1637	.1612
331E	.1668	.1648	.1626
333	.1671	.1645	.1615
333E	.1682	.1658	.1632
339	.1678	.1655	.1630
339E	.1677	.1658	.1635
343	.1680	.1657	.1631
343E	.1679	.1658	.1635
350	.1662	.1641	.1617
350E	.1655	.1637	.1615
351	.1724	.1699	.1670
351E	.1729	.1706	.1679
356	.1663	.1643	.1618
356E	.1648	.1629	.1607
358	.1655	.1634	.1609
358E	.1647	.1628	.1606
367	.1693	.1645	.1643
367E	.1698	.1676	.1659
370	.1701	.1677	.1650
370E	.1712	.1690	.1665
378	.1725	.1674	.1675

TABLE 28

(Continued)

Specimen Number	Capacity Index - (K - 1)/D		
	-65°F(-54°C)	32°F(0°C)	130°F(54°C)
378E	.1723	.1696	.1668
386	.1656	.1635	.1610
386E	.1653	.1632	.1610
393	.1657	.1635	.1610
393E	.1661	.1641	.1617
395	.1688	.1664	.1637
395E	.1676	.1654	.1629
399	.1708	.1685	.1658
399E	.1561	.1657	.1631
401	.1623	.1605	.1581
401E	.1623	.1624	.1597
405	.1690	.1663	.1634
405E	.1701	.1678	.1651
409	.1644	.1621	.1595
409E	.1638	.1631	.1608
413	.1686	.1661	.1632
413E	.1696	.1673	.1646

TABLE 29

Capacity Index at

-65°F(-54°C), 32°F(0°C), and 130°F(54°C)

Grade 115/145 Fuel

Specimen Number	Capacity Index - (K - 1)/D		
	-65°F(-54°C)	32°F(0°C)	130°F(54°C)
206	.1675	.1656	.1639
206E	.1643	.1625	.1605
208	.1652	.1628	.1611
208E	.1635	.1631	.1614
212	.1654	.1636	.1615
212E	.1657	.1640	.1619
218	.1637	.1617	.1594
218E	.1651	.1633	.1612
226	.1685	.1622	.1602
226E	.1659	.1644	.1627
231	.1663	.1646	.1625
231E	.1648	.1631	.1613
236	.1688	.1651	.1615
236E	.1682	.1653	.1646
244	.1670	.1651	.1631
244E	.1658	.1641	.1623
246	.1640	.1621	.1599
246E	.1664	.1648	.1629
251	.1673	.1654	.1631

TABLE 29

(Continued)

Specimen Number	Capacity Index - (K - 1)/D		
	-65°F(-54°C)	32°F(0°C)	130°F(54°C)
251E	.1682	.1664	.1645
257	.1697	.1680	.1660
257E	.1676	.1661	.1643
260	.1664	.1647	.1647
260E	.1638	.1639	.1590
266	.1649	.1631	.1610
266E	.1658	.1642	.1625
274	.1667	.1648	.1628
274E	.1656	.1639	.1619
278	.1654	.1636	.1615
278E	.1664	.1647	.1628
281	.1695	.1667	.1660
281E	.1686	.1665	.1652
282	.1637	.1626	.1604
282E	.1651	.1635	.1617
284	.1668	.1649	.1629
284E	.1649	.1631	.1613
292	.1652	.1634	.1612
292E	.1661	.1645	.1625
295	.1688	.1667	.1643
295E	.1694	.1678	.1657

TABLE 29

(Continued)

Specimen Number	Capacity Index - (K - 1)/D		
	-65°F(-54°C)	32°F(0°C)	130°F(54°C)
301	.1637	.1616	.1595
301E	.1688	.1671	.1654
305	.1675	.1656	.1635
305E	.1665	.1649	.1630
308	.1665	.1646	.1625
308E	.1682	.1665	.1647
313	.1660	.1633	.1633
313E	.1662	.1648	.1636
320	.1656	.1636	.1615
320E	.1632	.1613	.1593
324	.1656	.1638	.1617
324E	.1662	.1645	.1628
329	.1675	.1657	.1635
329E	.1693	.1677	.1660
334	.1675	.1644	.1632
334E	.1642	.1631	.1625
341	.1667	.1644	.1623
341E	.1677	.1656	.1639
342	.1632	.1638	.1591
342E	.1630	.1629	.1595
348	.1656	.1638	.1616
348E	.1646	.1629	.1610

TABLE 29

(Continued)

Specimen Number	Capacity Index - (K - 1)/D		
	-65°F(-54°C)	32°F(0°C)	130°F(54°C)
353	.1649	.1631	.1610
353E	.1653	.1638	.1621
355	.1657	.1640	.1619
355E	.1662	.1647	.1630
366	.1649	.1631	.1610
366E	.1660	.1644	.1626
368	.1645	.1626	.1604
368E	.1650	.1644	.1624
374	.1671	.1653	.1632
374E	.1666	.1650	.1632
376	.1693	.1676	.1655
376E	.1661	.1645	.1625
379	.1660	.1643	.1623
379E	.1659	.1643	.1625
389	.1661	.1644	.1623
389E	.1667	.1652	.1637
390	.1673	.1654	.1633
390E	.1668	.1652	.1633
402	.1661	.1641	.1632
402E	.1639	.1627	.1612
404	.1657	.1639	.1618

TABLE 29

(Continued)

Specimen Number	Capacity Index - (K - 1)/D		
	-65°F(-54°C)	32°F(0°C)	130°F(54°C)
404E	.1662	.1647	.1627
408	.1623	.1602	.1578
408E	.1643	.1624	.1603
411	.1658	.1663	.1642
411E	.1666	.1650	.1631

TABLE 30

Capacity Index at

-65°F(-54°C), 32°F(0°C), and 130°F(54°C)

Grade JP-1 Fuel

Specimen Number	Capacity Index - (K - 1)/D		
	-65°F(-54°C)	32°F(0°C)	130°F(54°C)
221	.1715	.1690	.1661
221E	.1709	.1684	.1654
224	.1718	.1695	.1667
224E	.1724	.1701	.1673
229	.1730	.1704	.1673
229E	.1738	.1712	.1680
233	.1710	.1680	.1643
233E	.1689	.1671	.1638
241	.1725	.1685	.1643
241E	.1698	.1681	.1636
249	.1692	.1666	.1638
249E	.1675	.1649	.1620
259	.1711	.1688	.1663
259E	.1707	.1684	.1658
264	.1731	.1702	.1679
264E	.1734	.1702	.1667
268	.1718	.1696	.1671
268E	.1715	.1691	.1667
276	.1658	.1634	.1607

TABLE 30

(Continued)

Specimen Number	Capacity Index - (K - 1)/D		
	-65°F(-54°C)	32°F(0°C)	130°F(54°C)
276E	.1710	.1688	.1662
287	.1717	.1687	.1659
287E	.1720	.1695	.1667
290	.1723	.1693	.1668
290E	.1733	.1697	.1676
293	.1714	.1691	.1665
293E	.1716	.1692	.1665
294	.1725	.1698	.1668
294E	.1728	.1701	.1671
306	.1700	.1677	.1650
306E	.1686	.1662	.1635
312	.1730	.1707	.1681
312E	.1718	.1694	.1668
316	.1734	.1705	.1675
316E	.1715	.1687	.1655
318	.1685	.1662	.1637
318E	.1667	.1641	.1614
322	.1728	.1701	.1671
322E	.1736	.1707	.1677
336	.1748	.1705	.1678
336E	.1748	.1705	.1691
344	.1691	.1681	.1635

TABLE 30

(Continued)

Specimen Number	Capacity Index - (K - 1)/D		
	-65°F(-54°C)	32°F(0°C)	130°F(54°C)
344E	.1692	.1666	.1636
357	.1718	.1691	.1662
357E	.1718	.1691	.1661
364	.1753	.1709	.1682
364E	.1744	.1711	.1685
377	.1744	.1708	.1689
377E	.1725	.1698	.1667

TABLE 31

Capacity Index at

-65°F(-54°C), 32°F(0°C), and 130°F(54°C)

Grade JP-3 Fuel

Specimen Number	Capacity Index - (K - 1)/D		
	-65°F(-54°C)	32°F(0°C)	130°F(54°C)
203	.1671	.1649	.1625
203E	.1690	.1671	.1648
209	.1721	.1674	.1650
209E	.1681	.1668	.1648
211	.1656	.1635	.1611
211E	.1668	.1652	.1629
222	.1722	.1695	.1664
222E	.1746	.1719	.1690
228	.1740	.1712	.1682
228E	.1759	.1733	.1702
232	.1696	.1670	.1643
232E	.1698	.1675	.1648
234	.1668	.1645	.1618
234E	.1675	.1653	.1628
248	.1737	.1691	.1665
248E	.1744	.1702	.1684
254	.1675	.1650	.1624
254E	.1682	.1660	.1635
262	.1756	.1729	.1698

TABLE 31

(Continued)

Specimen Number	Capacity Index - (K - 1)/D		
	-65°F(-54°C)	32°F(0°C)	130°F(54°C)
262E	.1773	.1747	.1718
277	.1689	.1672	.1659
277E	.1690	.1669	.1647
283	.1696	.1681	.1669
283E	.1687	.1673	.1667
302	.1715	.1690	.1662
302E	.1700	.1675	.1648
311	.1740	.1712	.1681
311E	.1742	.1714	.1684
315	.1723	.1694	.1650
315E	.1711	.1683	.1650
317	.1695	.1667	.1636
317E	.1711	.1683	.1652
325	.1731	.1701	.1668
325E	.1726	.1696	.1663
337	.1696	.1673	.1645
337E	.1710	.1688	.1662
338	.1669	.1636	.1608
338E	.1681	.1657	.1631
345	.1713	.1685	.1654
345E	.1688	.1661	.1631
347	.1705	.1664	.1647

TABLE 31

(Continued)

Specimen Number	Capacity Index - (K - 1)/D		
	-65°F(-54°C)	32°F(0°C)	130°F(54°C)
347E	.1727	.1701	.1671
359	.1687	.1661	.1665
359E	.1696	.1667	.1649
360	.1696	.1676	.1653
360E	.1681	.1660	.1635
361	.1704	.1675	.1642
361E	.1722	.1695	.1664
369	.1703	.1677	.1647
369E	.1707	.1682	.1652
372	.1666	.1643	.1645
372E	.1684	.1663	.1639
375	.1690	.1666	.1638
375E	.1689	.1665	.1638
385	.1712	.1683	.1648
385E	.1692	.1662	.1628
391	.1741	.1715	.1689
391E	.1745	.1720	.1694
394	.1691	.1668	.1643
394E	.1685	.1664	.1639
397	.1687	.1664	.1637
397E	.1685	.1664	.1640
403	.1733	.1687	.1660

TABLE 31

(Continued)

Specimen Number	Capacity Index - (K - 1)/D		
	-65°F(-54°C)	32°F(0°C)	130°F(54°C)
403E	.1700	.1667	.1647
407	.1668	.1645	.1618
407E	.1659	.1656	.1632
410	.1710	.1682	.1650
410E	.1726	.1699	.1668
416	.1674	.1652	.1626
416E	.1663	.1641	.1617

TABLE 32

Capacity Index at

-65°F(-54°C), 32°F(0°C), and 130°F(54°C)

Grade JP-4 Fuel

Specimen Number		Capacity Index - (K-1)/D		
		-65°F(-54°C)	32°F(0°C)	130°F(54°C)
415	MLF-5411	.1687	.1656	.1641
415E		.1694	.1663	.1640
417	MLF-5477	.1691	.1651	.1652
417E		.1680	.1655	.1629
418	MLF-5478	.1681	.1663	.1641
418E		.1690	.1664	.1639
419	MLF-5484	.1694	.1651	.1646
419E		.1629	.1666	.1672
420	MIF-5494	.1696	.1654	.1642
420E		.1694	.1644	.1624
421	MIF-5541	.1698	.1656	.1646
421E		.1702	.1656	.1645

TABLE 33

EFFECT OF MOISTURE CONTENT

(Saturation with Distilled Water)

Specimen Number	Grade	Moisture Content at 77°F(25°C) Milligrams per Liter of Fuel			Dielectric Constant AT 400 Cps and 77°F(25°C)			Change in Dissipation Factor - %
		As Received	After Saturation	% Increase	As Received	After Saturation	% Increase	
362	91/98	11	21	91	1.9456	1.9535	.41	0
363		10	13	30	1.9606	1.9594	-.06	
365		13	25	92	1.9456	1.9493	.19	0
367	100/130	15	22	47	1.9798	1.9862	.32	0
378		16	26	62	1.9914	2.0000	.43	0
395		14	19	36	1.9596	1.9602	.03	
366	115/145	13	15	15	1.9236	1.9243	.04	
368		12	22	83	1.9370	1.9445	.39	0
376		12	17	42	1.9397	1.9398	.01	
361	JP-3	25	24	- 4	2.0930	2.0959	.14	0
369		22	27	23	2.0626	2.0651	.12	0
375		14	22	57	2.0251	2.0277	.13	0
415	JP-4	24	31	29	2.0151	2.0198	.23	0

TABLE 34

EFFECT OF MOISTURE CONTENT

(Saturated with Synthetic Hard Water)

Specimen Number	Grade	Moisture Content at 77°F(25°C) Milligrams per Liter of Fuel			Dielectric Constant at 400 Cps and 77°F(25°C)			Change in Dissipation Factor - %
		As Received	After Saturation	% Increase	As Received	After Saturation	% Increase	
362	91/98	11	22	100	1.9456	1.9453	-.02	0
363		10	20	100	1.9606	1.9618	.06	0
365		13	19	46	1.9456	1.9415	-.21	0
367	100/130	15	23	53	1.9798	1.9783	-.08	0
378		16	32	100	1.9914	1.9939	.13	0
395		14	26	86	1.9596	1.9604		0
366	115/145	13	28	115	1.9236	1.9247	.04	0
368		12	29	142	1.9370	1.9370	0	0
376		12	27	125	1.9397	1.9401	.02	0
361	JP-3	25	30	20	2.0930	2.0953	.11	0
369		22	31	41	2.0626	2.0655	.14	0
375		14	24	71	2.0251	2.0270	.09	0
415	JP-4	24	33	38	2.0151	2.0195	.22	0

TABLE 35

EFFECT OF MOISTURE CONTENT

(Saturated with Synthetic Sea Water)

Specimen Number	Grade	Moisture Content at 77°F(25°) Milligrams per Liter of Fuel			Dielectric Constant at 400 Cps and 77°F(25°C)			Change in Dissipation Factor - %
		As Received	After Saturation	% Increase	As Received	After Saturation	% Increase	
362	91/98	11	23	109	1.9456	1.9440	- .08	0
363		10	20	100	1.9606	1.9590	- .08	0
365		13	21	62	1.9456	1.9406	- .26	0
367	100/130	15	24	60	1.9798	1.9769	- .15	0
378		16	21	31	1.9914	1.9928	.07	0
395		14	20	43	1.9596	1.9601	.03	0
366	115/145	13	19	46	1.9236	1.9239	.02	0
368		12	20	67	1.9370	1.9367	- .02	0
376		12	19	58	1.9397	1.9398	.01	0
361	JP-3	25	27	8	2.0930	2.0948	.09	0
369		22	31	41	2.0626	2.0652	.13	0
375		14	24	71	2.0251	2.0276	.12	0
415	JP-4	24	31	29	2.0151	2.0195	.22	0

TABLE 36

CHEMICAL PROPERTIES

Grade 91/98 Fuels

Specimen Number	Dielectric Constant at 400 Cps-32°F(0°C)	Initial Boiling Point - °F	Aniline Gravity Constant	Tetraethyl Lead-cc/gal	Sulfur %
200	1.999		8127	3.79	.01
201	1.970	108		2.82	
205	1.969	118	10636	3.74	.012
215	1.972	113	10251	2.92	
216	1.964	112	10660	3.86	.011
219	2.000		7842	4.49	.04
223	1.968	134	9638	2.22	.02
227	2.013		7330	4.26	.02
238	1.973	109	10393	2.94	
239	1.966	116	10636	3.73	.011
242	1.968	132	9716	2.15	.02
252	2.008	126	8684	3.59	.03
253	1.997	104	8204	3.81	.02
256	1.969	118	10589	3.70	.018
261	1.982	116		4.00	.03
265	1.970	115	10430	3.87	.013
270	1.969	110	10081	2.84	
412	1.983	122	9071	3.58	.01
414	2.010	119	8382	3.75	.009

TABLE 36

(Continued)

Specimen Number	Dielectric Constant at 400 Cps-32°F(0°C)	Initial Boiling Point - °F	Aniline Gravity Constant	Tetraethyl Lead-cc/gal	Sulfur %
280	1.980	128	9501	2.85	.03
286	2.010		7863	4.53	.04
288	2.007	124	8550	3.86	.03
298	1.974	108	10787	3.02	.014
299	2.010	123	8337	3.73	.019
307	2.008	124	8457	3.95	.02
310	1.984	116		4.00	.03
326	2.002	106	7744	3.96	.01
328	2.015	126	7977	3.80	.008
332	1.973	115	9849	2.98	
335	2.008	104	8333	3.79	.02
346	1.975	104	11045	2.98	.044
349	2.013		7731	4.25	.03
352	2.027	124	7566	3.88	.016
362	1.976	120	8818	2.96	.02
363	1.992		8096	3.75	.01
365	1.968	108	10721	3.01	.013
371	2.030	122	7650	3.68	.017
373	2.016	126	7893	3.80	.031
387	1.981	124	9112	2.80	.02
392	1.962		11118	3.91	.043
396	1.971	110	10771	2.97	.022
398	2.038	115	8291	3.89	.015
400	1.997		8071	3.84	.01
406	1.988	116	9112	3.95	.013

TABLE 37

CHEMICAL PROPERTIES

Grade 100/130 Fuels

Specimen Number	Dielectric Constant at 400 Cps-32°F(0°C)	Initial Boiling Point - °F	Aniline Gravity Constant	Tetraethyl Lead-cc/gal	Sulfur %
202	1.951	109	11814	2.99	
207	2.007	116	9636	3.58	.017
213	1.959	106	11928	2.92	
214	1.985	113	11167	3.87	.009
220	2.019		7860	4.60	.03
225	1.972		10200	3.82	.01
230	1.971	102	11504	2.98	.013
237	1.967	110	11263	4.02	.015
240	1.953	108	11848	2.89	
243	1.960		11828	4.53	.029
250	1.967	100		4.60	.03
255	1.962	107	11765	2.79	
258	1.968	124	11427	3.76	.012
263	1.961	106	10884	4.55	.01
267	1.959		10852	4.45	.0179
271	1.973	106	11765	2.98	
272	2.028	119	8064	3.90	.009
285	1.977	100		4.60	.02
289	1.972	111	10622	4.52	.02
297	2.029	126	8828	4.33	.020

TABLE 37

(Continued)

Specimen Number	Dielectric Constant at 400 Cps-32°F(0°C)	Initial Boiling Point - °F	Aniline Gravity Constant	Tetraethyl Lead-cc/gal	Sulfur %
300	2.016	104	8699	2.98	.023
304	1.966	106	9838	2.98	
314	1.969		11765	4.25	.029
319	2.015	102	8974	2.96	.02
327	1.991		9030	4.58	.01
330	2.032	116	7909	4.32	.006
331	1.964	104	11699	2.90	
333	2.007			4.60	.04
339	1.985	108	10430	2.84	.018
350	1.962	111	11566	3.81	.01
351	2.048	114	7697	4.39	.011
356	1.968		11700	4.60	.03
367	2.008		7514	4.58	.04
370	2.018	106	8791	4.54	.02
378	2.020	109	8462	2.93	.02
386	1.968		11426	4.60	.02
393	1.963		11942	4.51	.049
395	2.003				
399	2.019	116	7545	4.17	.012
401	1.950	114	10980	3.89	.02
405	2.022	116	7891	4.31	.014
409	1.966	108	10978	4.52	.01
413	2.017	122	8467	4.24	.016

TABLE 38

CHEMICAL PROPERTIES

Grade 115/145 Fuels

Specimen Number	Dielectric Constant at 400 Cps-32°F(0°C)	Initial Boiling Point - °F	Aniline Gravity Constant	Tetraethyl Lead-cc/gal	Sulfur %
206	1.974	105	11455	3.24	.034
212	1.969	109	11268	4.45	
218	1.966		11116	4.44	.01
226	1.947	106	12078	4.60	.02
231	1.969	104	11704	4.50	.018
236	1.977	103	11253	4.56	.034
244	1.971		11780	4.60	.029
251	1.987		10805	4.59	.03
257	1.991	102	11314	4.56	.03
260	1.976	102	11646	4.47	.01
266	1.955		11778	4.56	.0174
281	1.984	101	11471	4.58	.026
282	1.952		11991	4.60	.029
284	1.976	103	11506	4.59	.01
295	2.007	105	9662	4.51	.022
301	1.959		11360	4.58	.01
305	1.977	102	11472	4.56	.028
308	1.973		11214	4.54	.029
313	1.965	102	11830	4.39	.02

TABLE 38

(Continued)

Specimen Number	Dielectric Constant at 400 Cps-32°F(0°C)	Initial Boiling Point - °F	Aniline Gravity Constant	Tetraethyl Lead-cc/gal	Sulfur %
324	1.967		11540	4.60	.02
329	1.977	102	11319	4.54	.027
334	1.964	100		4.50	.01
341	1.977	109	10768	4.37	.017
348	1.968	106	11695	4.58	.01
355	1.959	100	12144	4.49	.01
366	1.957	100	11957	4.59	.02
368	1.964	102	11270	4.37	.023
374	1.973	104	11294	4.52	.027
376	1.987	103	11500	4.59	.030
379	1.964		12012	4.48	.020
389	1.962	100	12074	4.55	.01
390	1.977	102	11228	4.56	.030
402	1.967	114	11827	4.55	.01
404	1.971	106	11315	4.52	.03
408	1.955		10861	4.58	.02
411	1.980	104	11451	4.60	.027

TABLE 39

CHEMICAL PROPERTIES

Grade JP-1 Fuel

Specimen Number	Dielectric Constant at 400 Cps-32°F(0°C)	Aromatics Per Cent	Initial Boiling Point - °F	Sulfur %
221	2.161	14.4	345	.12
224	2.142	19.8		.017
229	2.187	18.0		.06
233	2.123	8.1	320	.017
241	2.120	18.4		.042
249	2.137	2.5		.05
259	2.122	18.4		.042
264	2.179	16.6		.09
268	2.131	12.0		.126
276	2.092	18.8		.045
287	2.150	16.7		.10
290	2.174	16.7		.10
293	2.134	18.8		.03
294	2.180	17.0	340	.064
306	2.127	16.0	310	.01
312	2.145	19.8		.024
318	2.107	12.0	316	.12
322	2.187	18.0		.05

TABLE 39

(Continued)

Specimen Number	Dielectric Constant at 400 Cps-32°F(0°C)	Aromatics Per Cent	Initial Boiling Point - °F	Sulfur %
336	2.183	16.7		.10
344	2.144	8.0		.12
357	2.166	7.8		.12
364	2.182	14.0	355	.17
377	2.189	20.0	320	.042

TABLE 40

CHEMICAL PROPERTIES

Grade JP-3 Fuel

Specimen Number	Dielectric Constant at 400 Cps-32°F(0°C)	Aromatics Per Cent	Initial Boiling Point - °F	Sulfur %
222	2.118	15.7	108	.10
228	2.135	10.0		
232	2.074	4.2		.017
248	2.127	17.97		.07
262	2.146	11.3		.32
283	2.098	5.4		.19
302	2.095	21.0	102	.013
311	2.136	11.2	109	.15
317	2.103	15.0	96	.045
325	2.152	15.0		.09
337	2.073	4.0		.16
338	2.045	6.82	95	.04
345	2.109	14.26		.037
361	2.119	12.17		.19
369	2.099	12.0		.04
375	2.065	10.0	103	.023
391	2.108	7.2		.46
397	2.049	8.0	100	.05
403	2.120	9.5	113	.11
407	2.039	8.0	114	.048
410	2.127	10.74		.015

TABLE 41

Dielectric Constant, Density, and Capacity Index at 77°F(25°C)

Specimen Number	Identification	Dielectric Constant at 400 cps	Density Lb/Gallon	Capacity Index (K-1)/D
MLF-5583	Fuel from loading truck for B-36	1.9430	5.725	.1647
MLF-5584	Fuel from B-36, #4 engine, Before flight	1.9450	5.745	.1645
MLF-5585	Fuel from B-36, #4 engine, After flight	1.9448	5.747	.1644

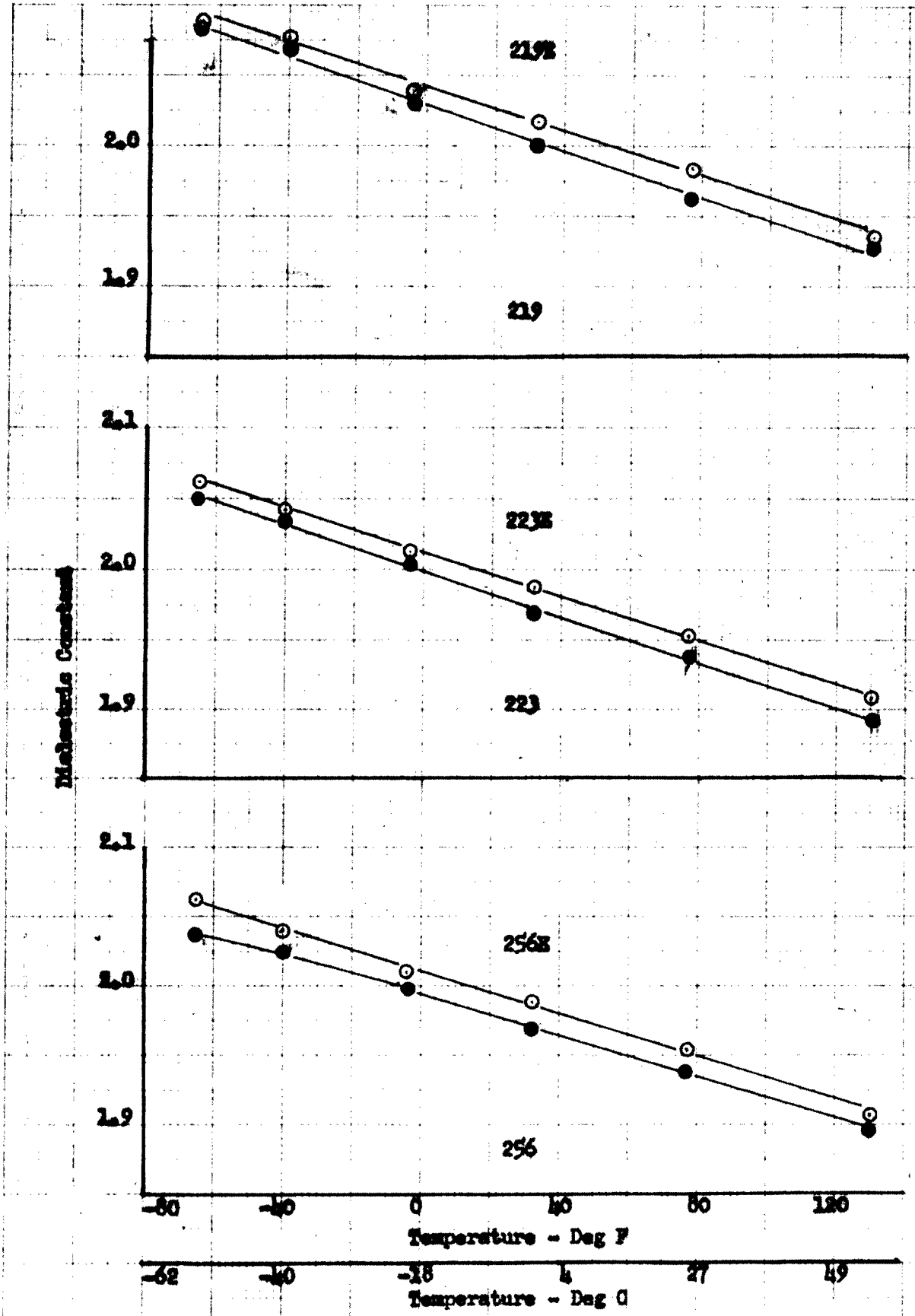


FIG. 6

Dielectric Constant vs. Temperature at 400 Cycles, Grade 91/98 Fuels

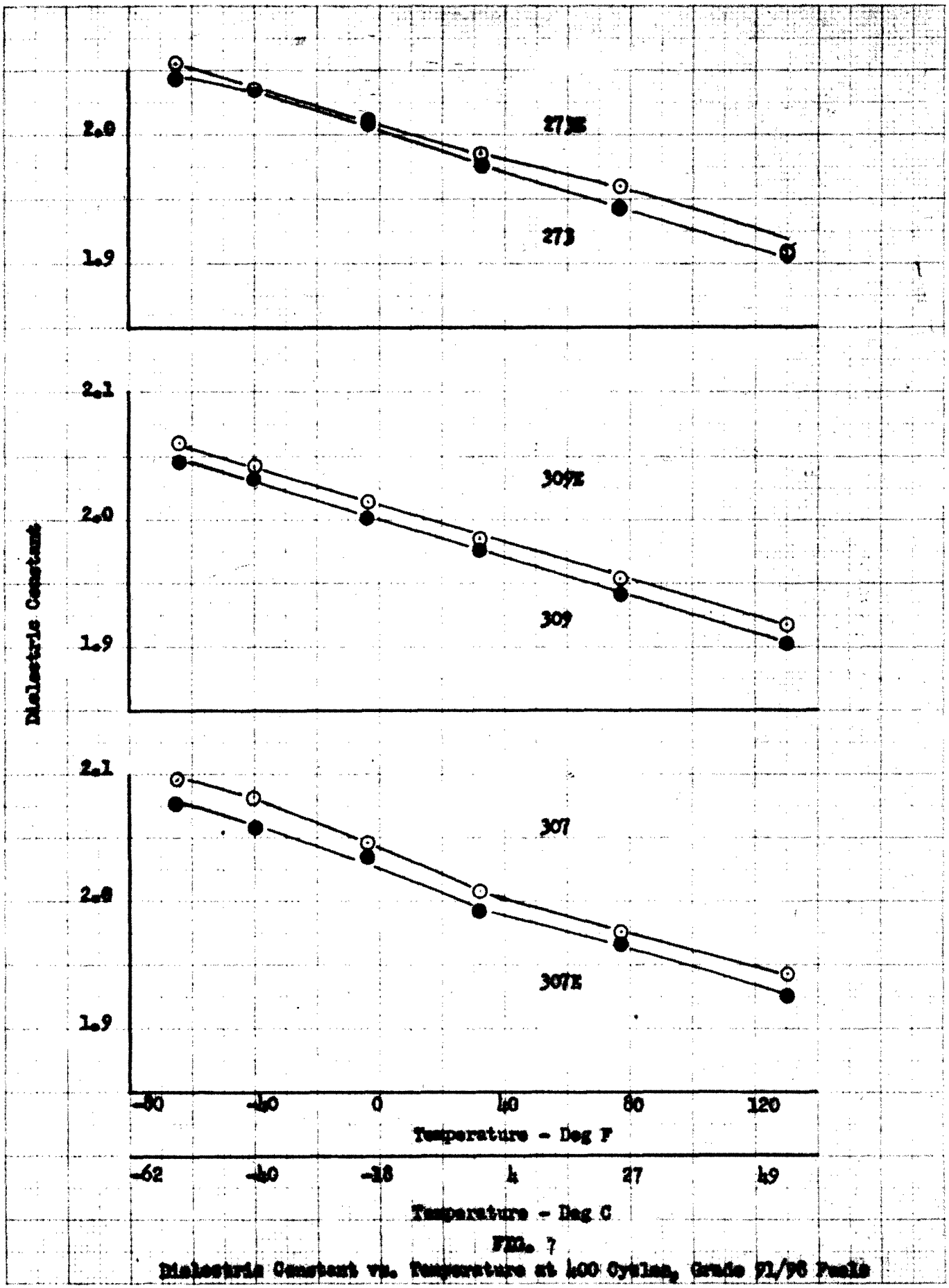


FIG. 7

Dielectric Constant vs. Temperature at 400 Cycles, Grade 91/96 Paste

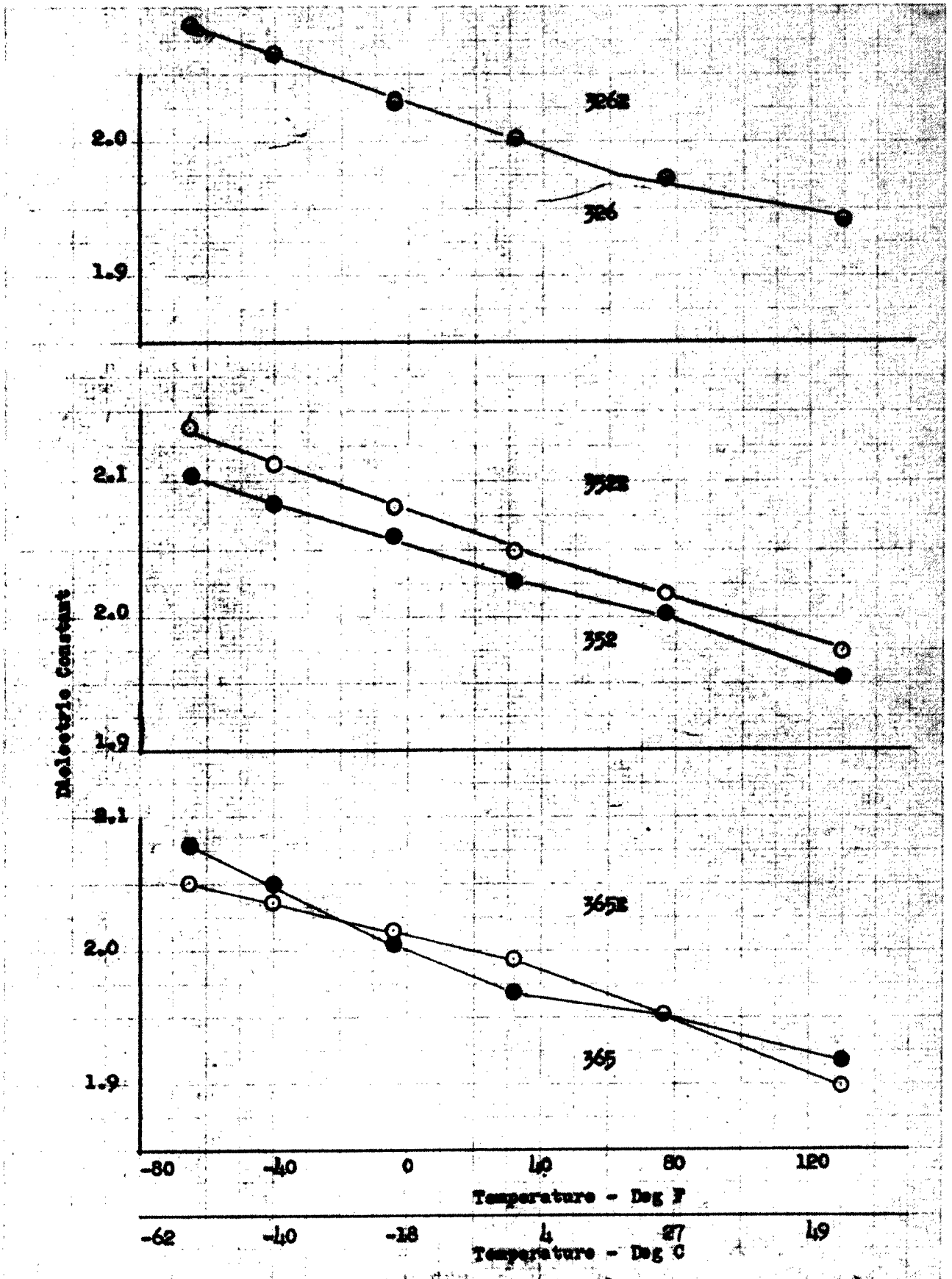


FIG. 8

Dielectric Constant vs. Temperature at 400 Cycles, Grade 91/93 Tuels

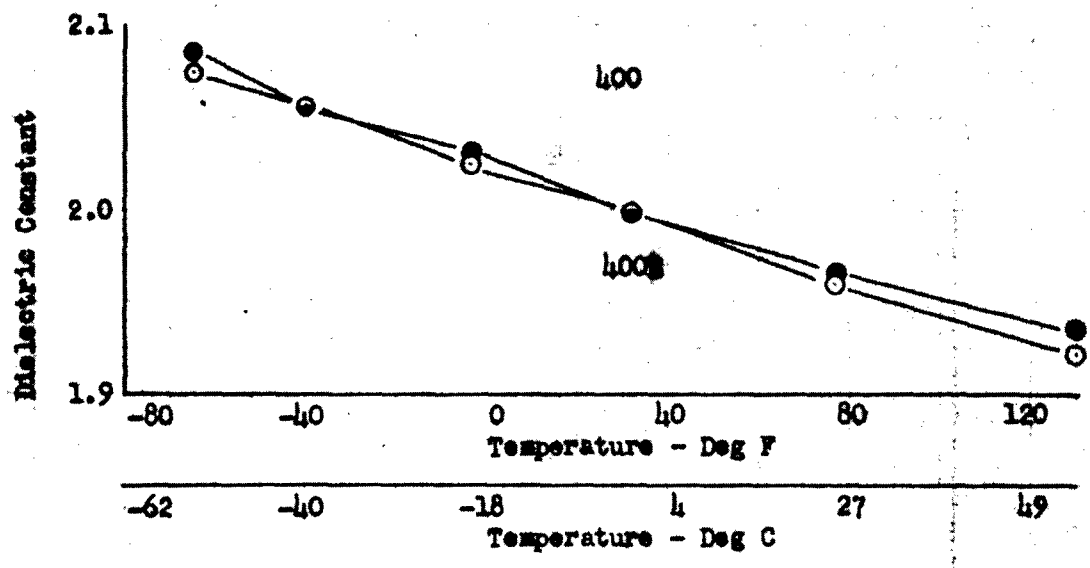


FIG. 9

Dielectric Constant vs. Temperature at 400 Cycles, Grade 91/98 Fuels

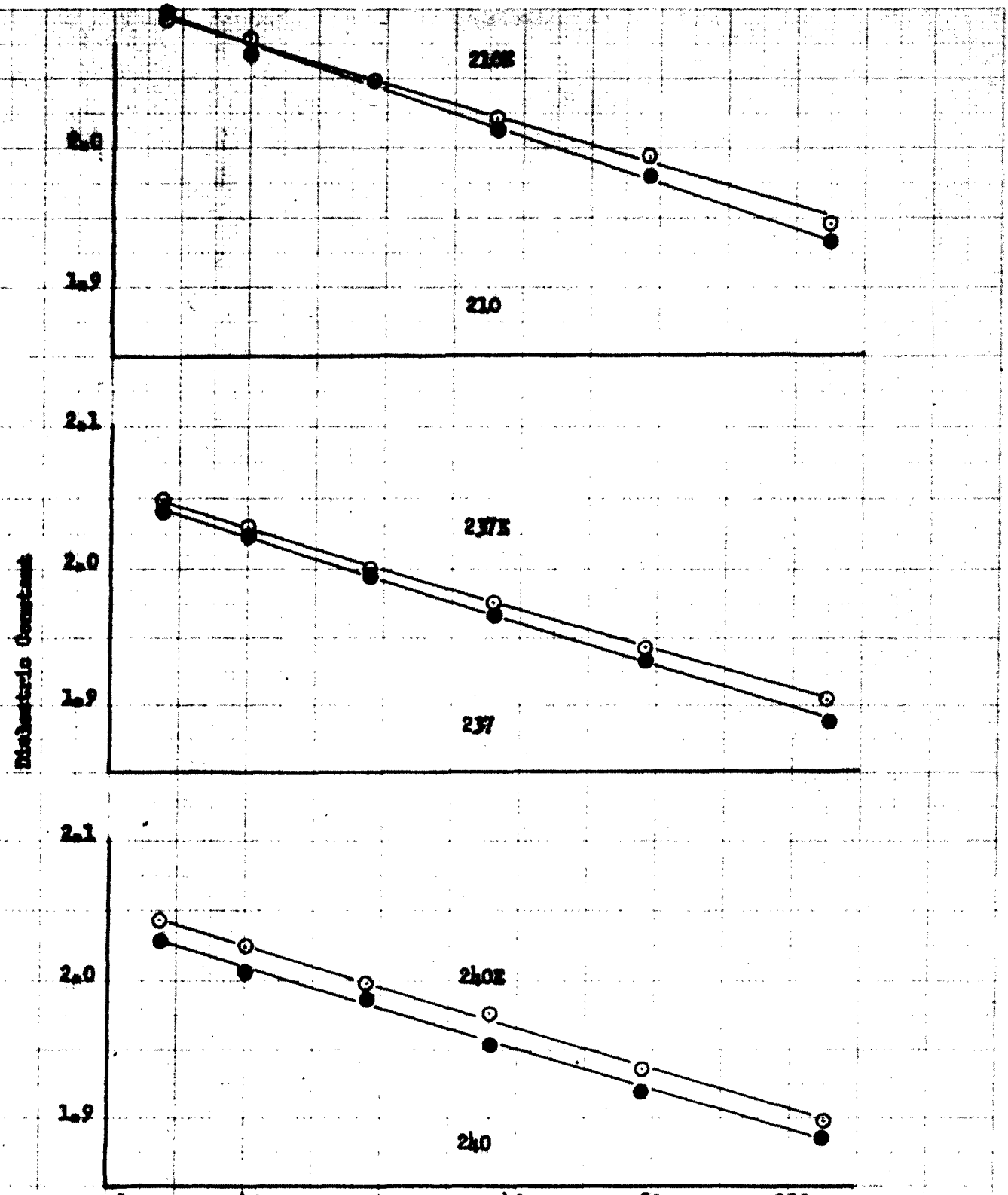


FIG. 10

Dielectric Constant vs. Temperature at 400 Cycles, Grade 100/130 Fuels

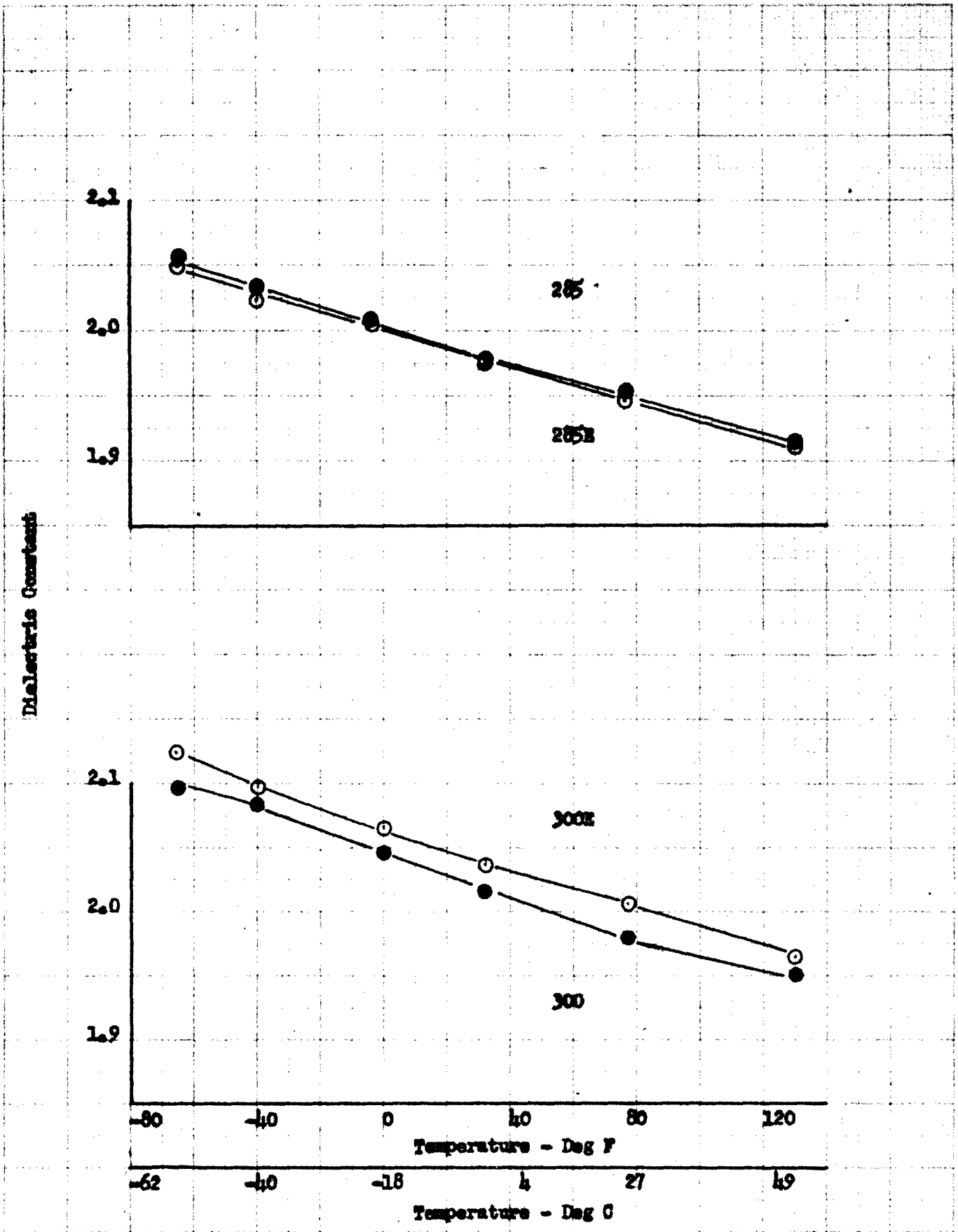


FIG. 11

Dielectric Constant vs. Temperature at 400 Cycles, Grade 100/130 Fuels

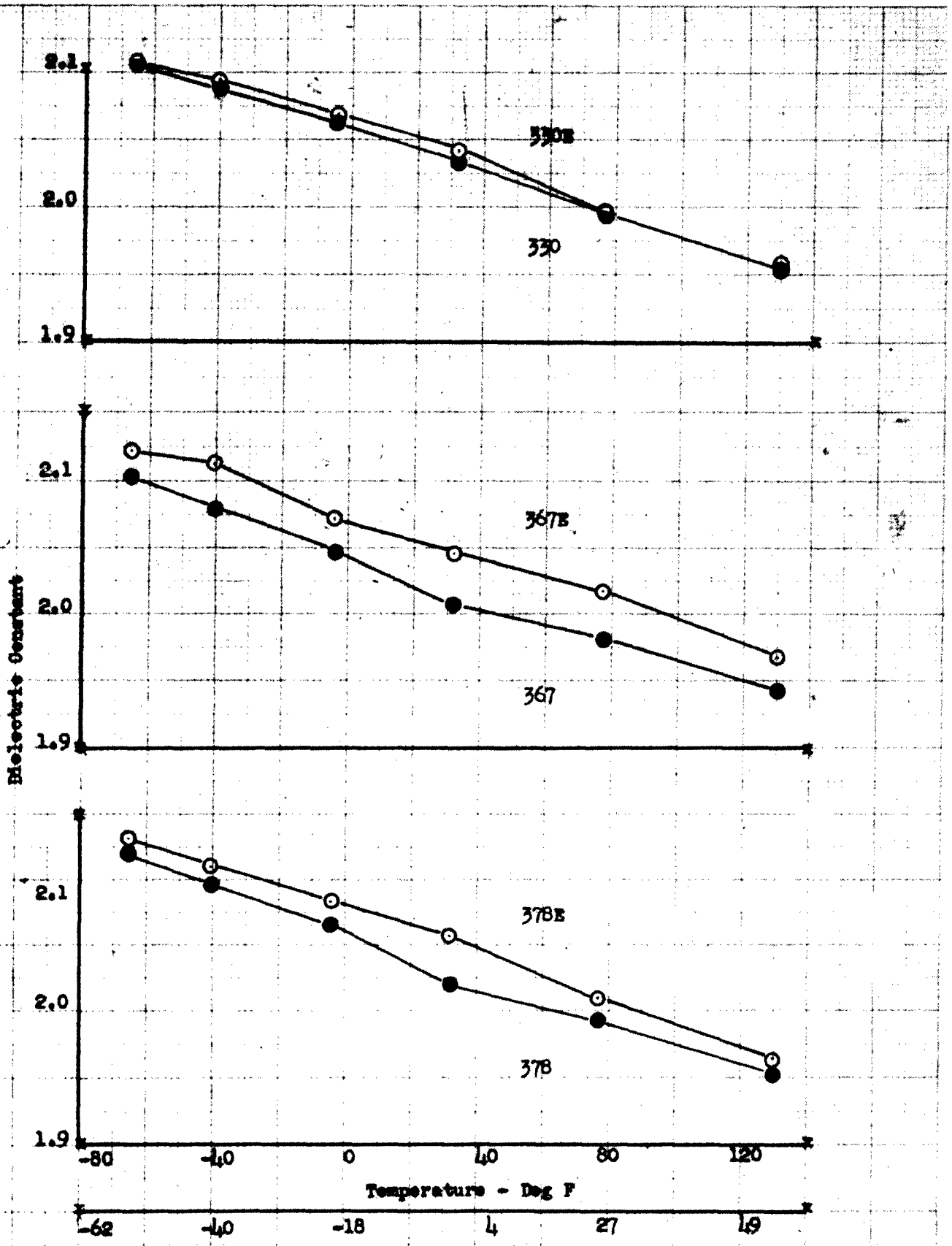


FIG. 12

Dielectric Constant vs. Temperature at 400 Cycles, Grade 100/130 Fuels

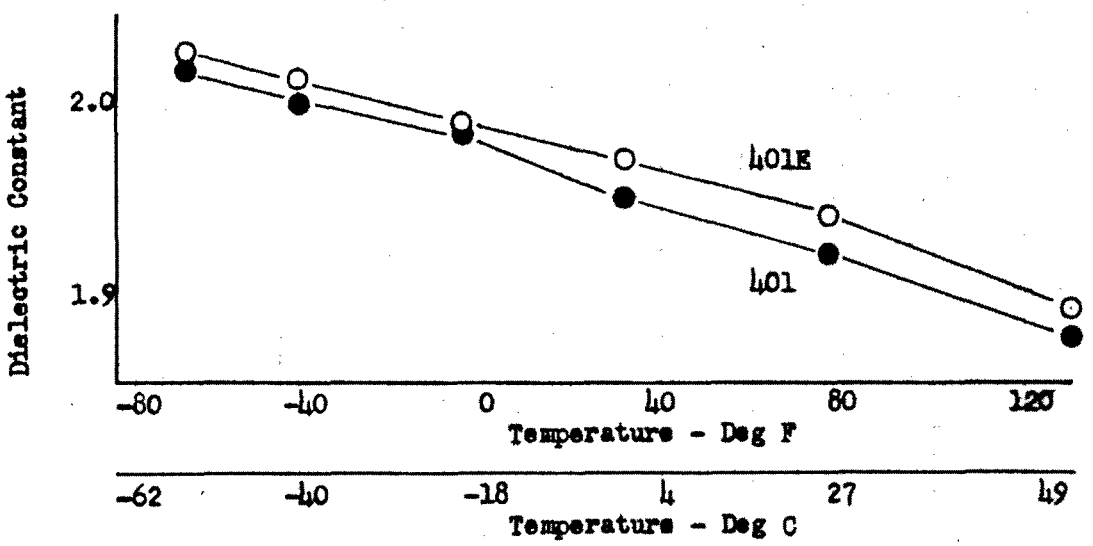


FIG. 13

Dielectric Constant vs. Temperature at 400 Cycles, Grade 100/130 Fuels

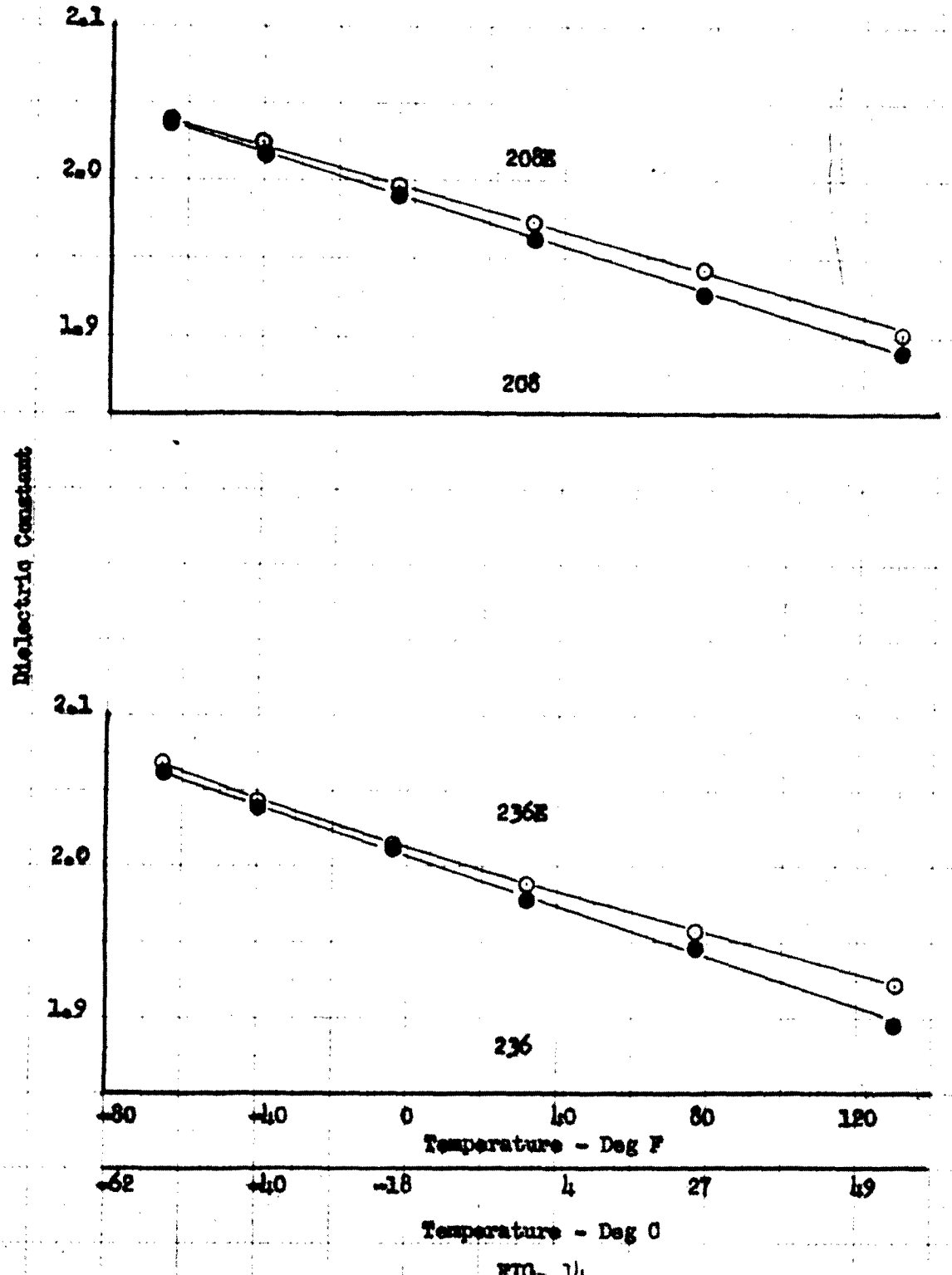


FIG. 14

Dielectric Constant vs. Temperature at 400 Cycles, Grade 115/145 Fuels

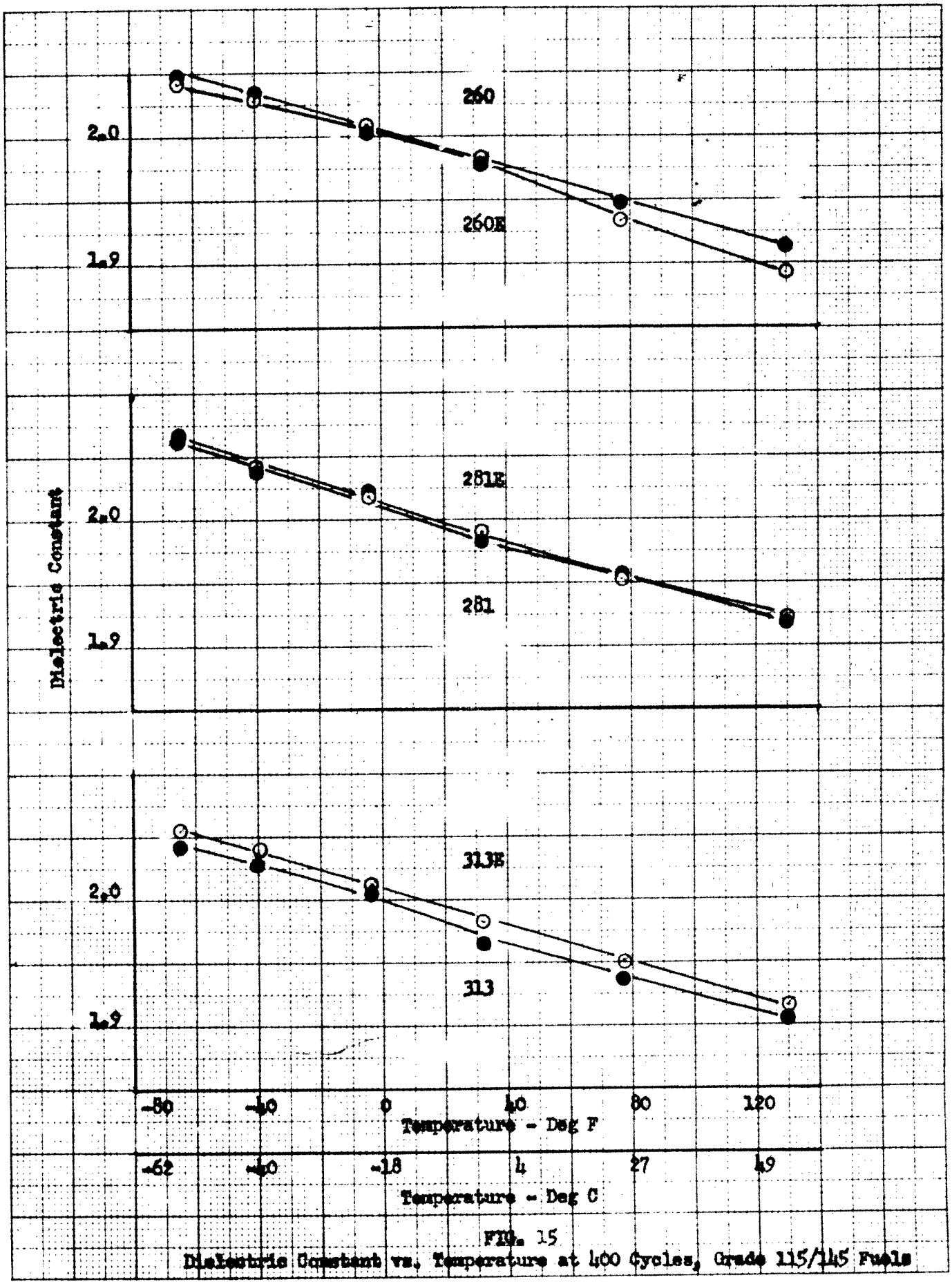


FIG. 15

Dielectric Constant vs. Temperature at 400 Cycles, Grade 115/145 Fuels

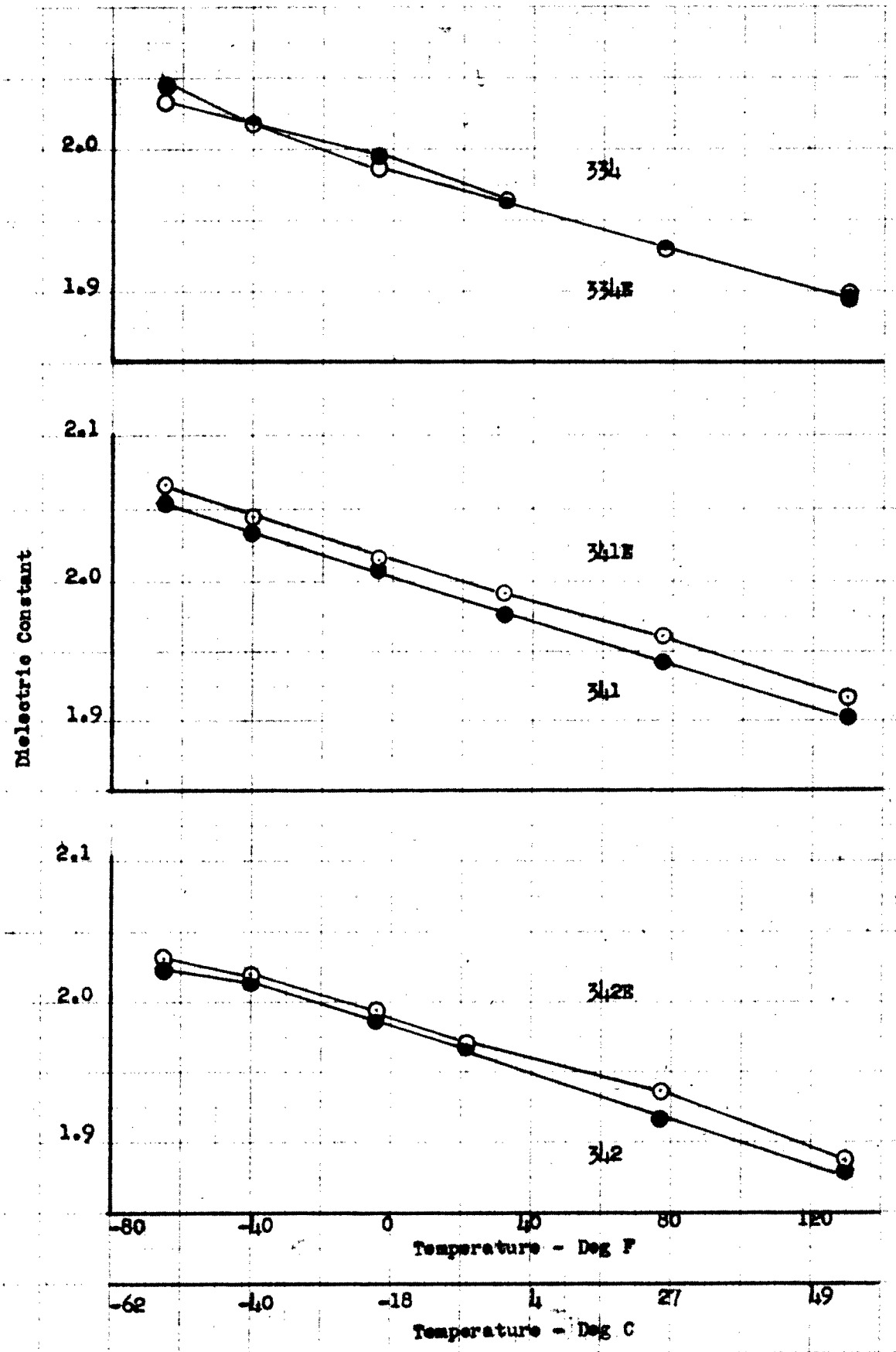


FIG. 16

Dielectric Constant vs. Temperature at 400 Cycles, Grade 115/145 Fuels

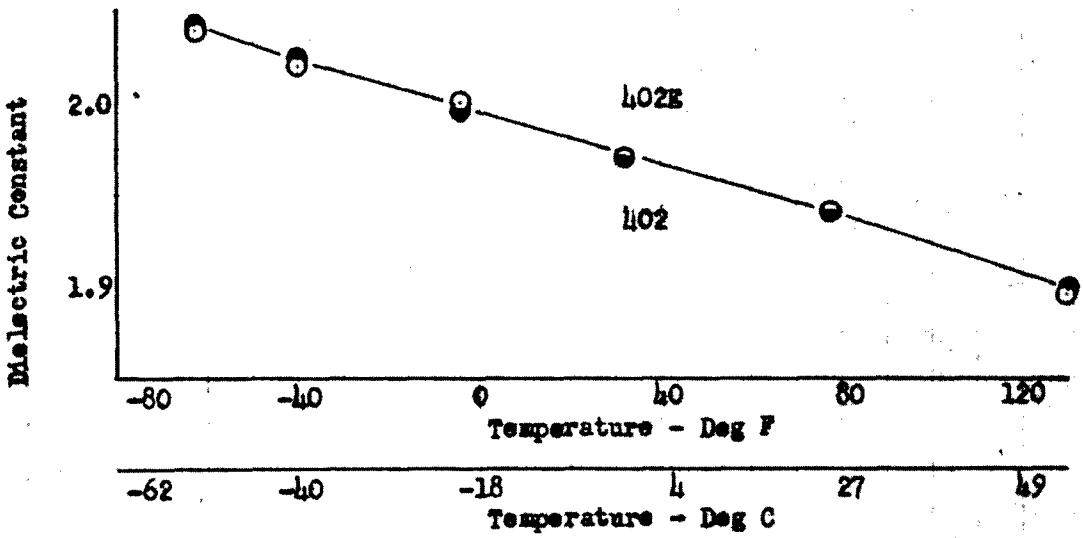


FIG. 17

Dielectric Constant vs. Temperature at 400 Cycles, Grade 115/145 Fuels

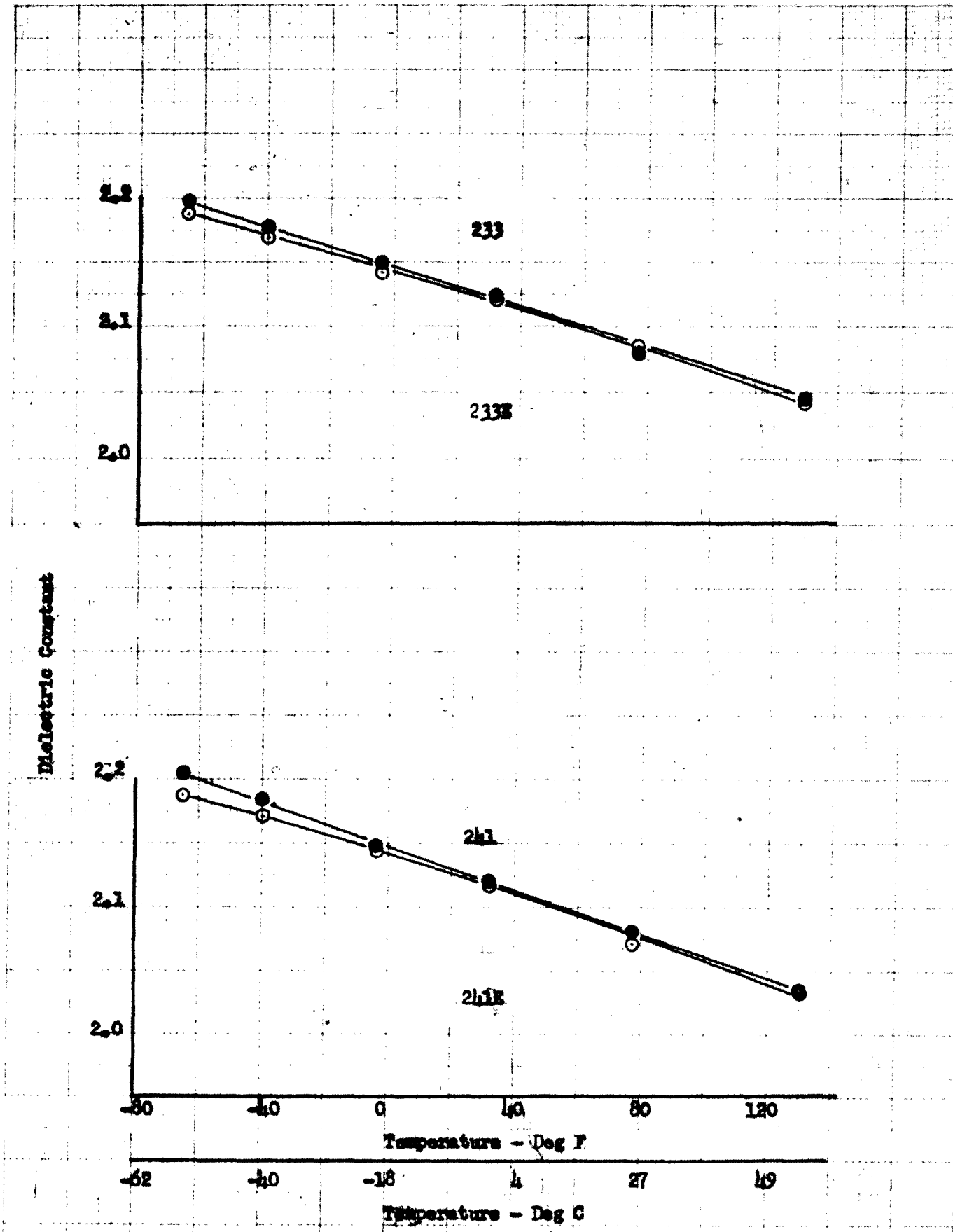


FIG. 18

Dielectric Constant vs. Temperature at 400 Cycles, Crude JP-1 Fuels

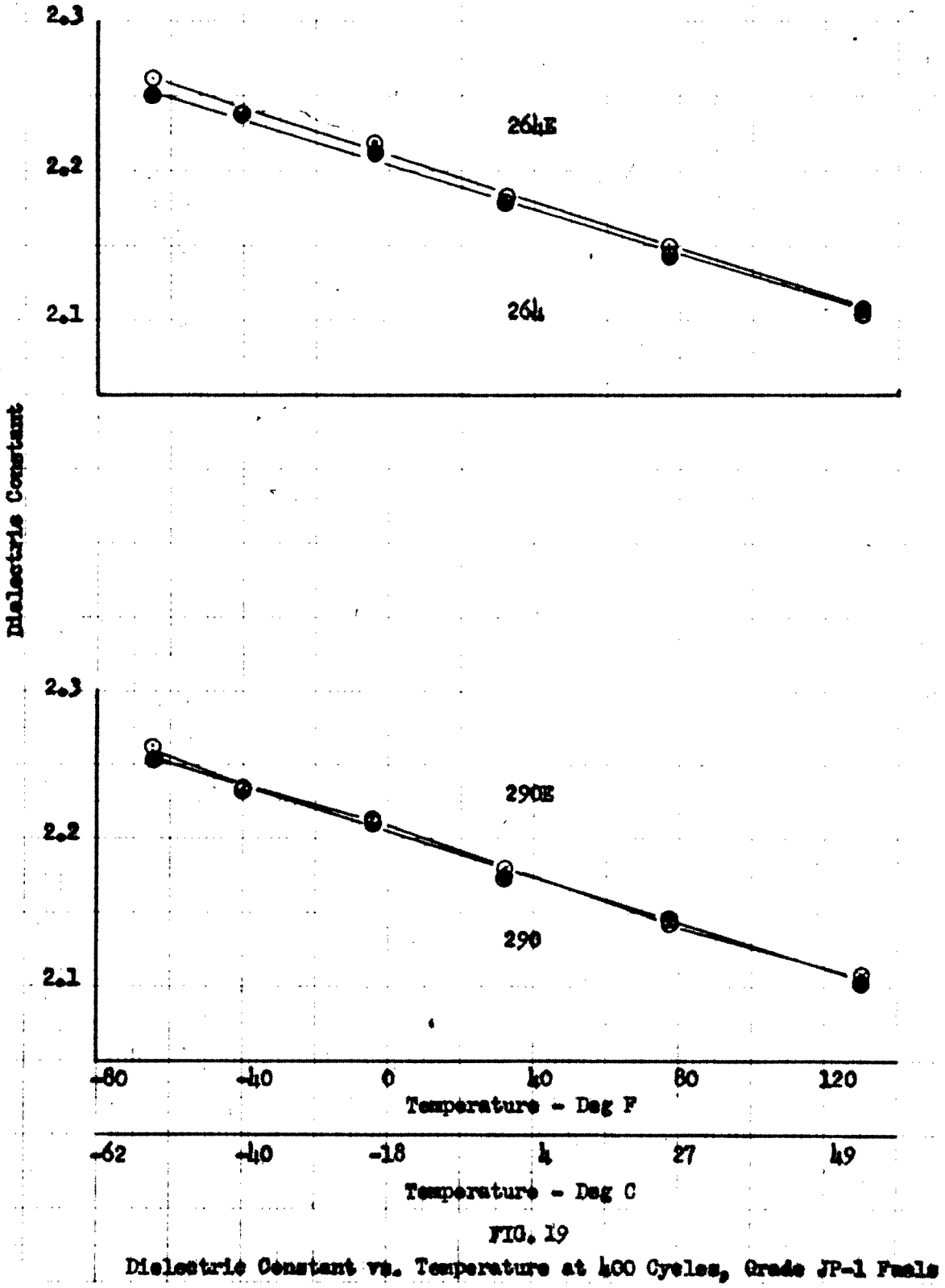


FIG. 19

Dielectric Constant vs. Temperature at 400 Cycles, Grade JP-1 Fuels

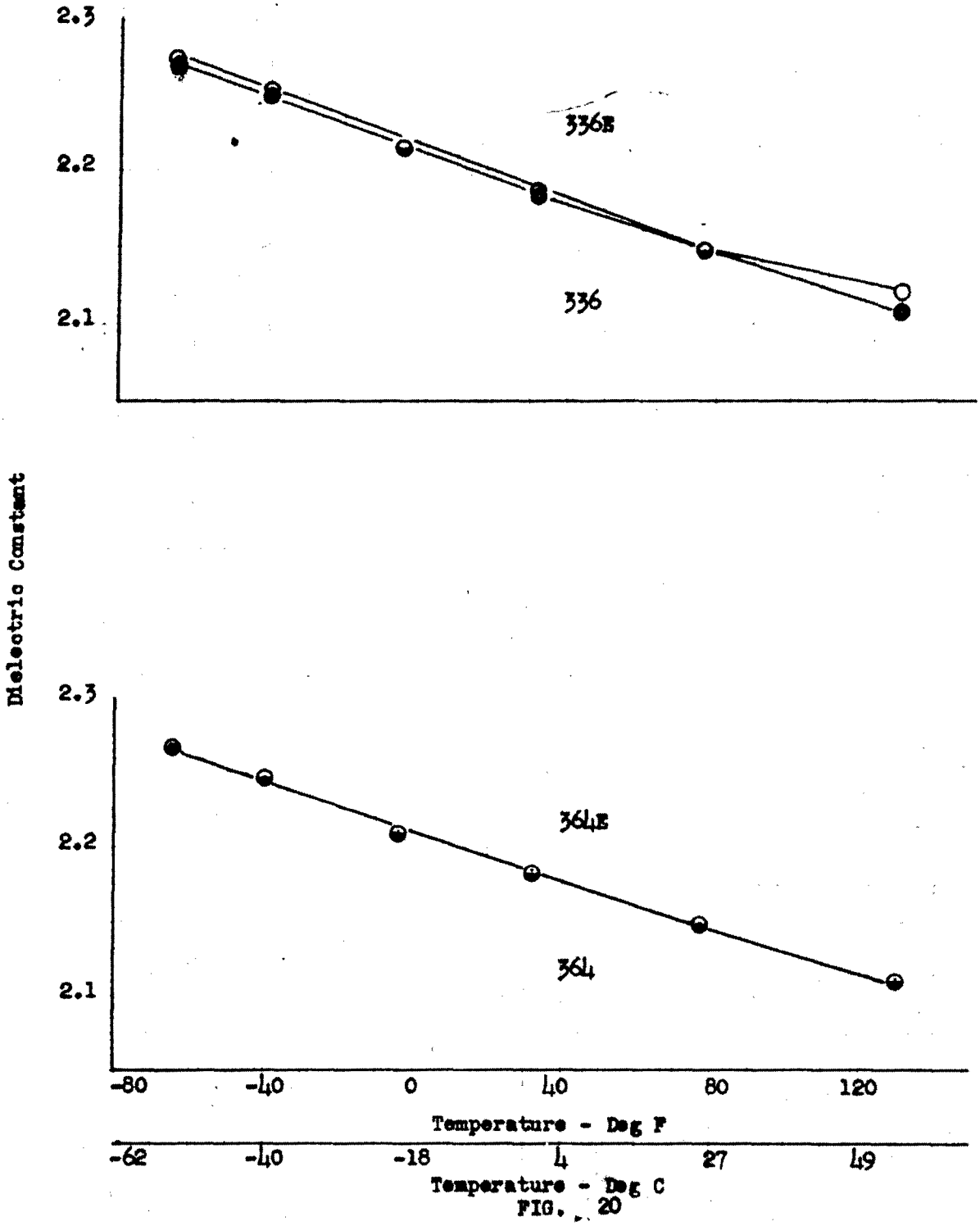


FIG. 20

Dielectric Constant vs. Temperature at 400 Cycles, Grade JP-1 Fuels

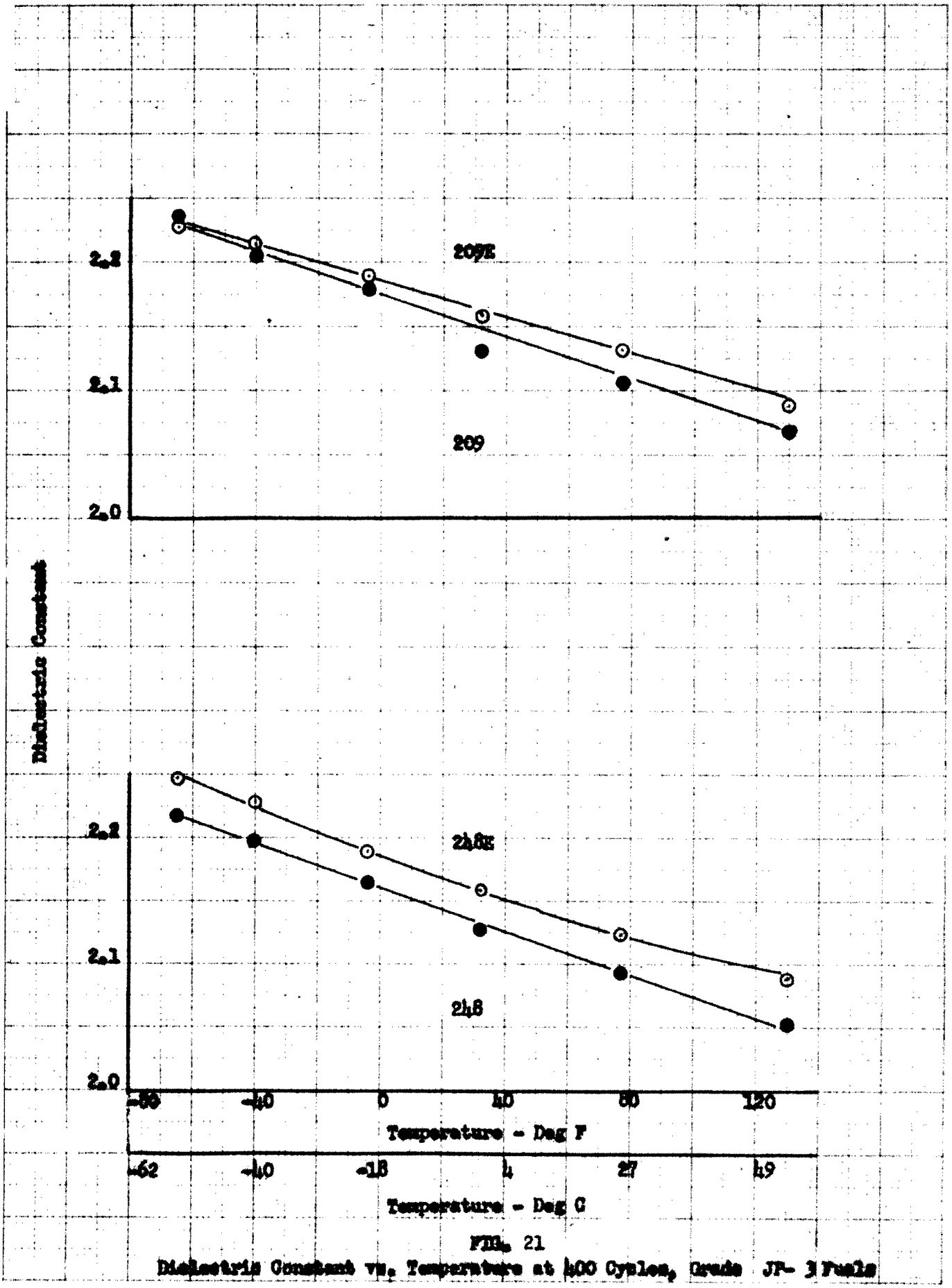


FIG. 21

Dielectric Constant vs. Temperature at 400 Cycles, Crude JP- 3 Fuels

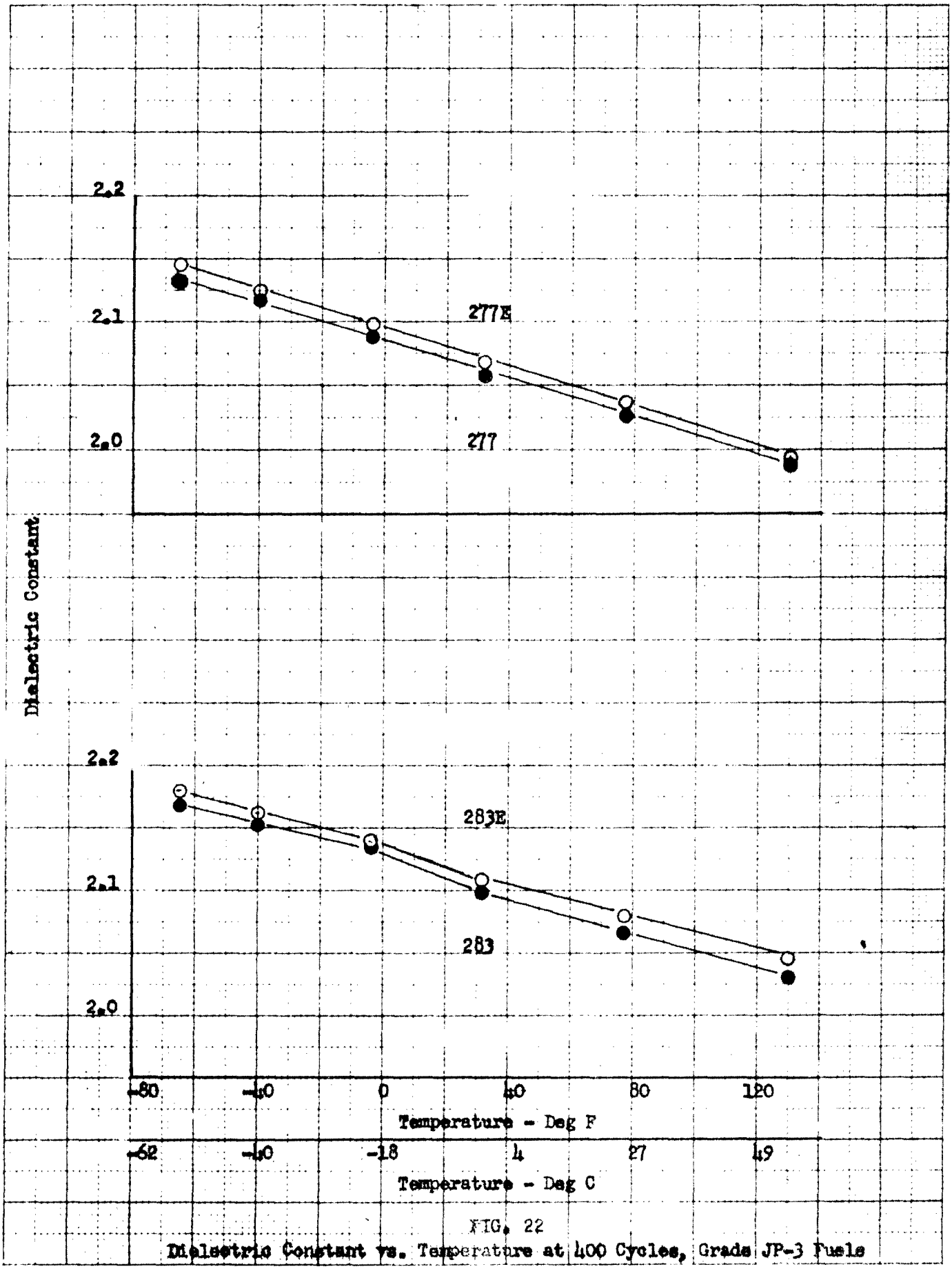


FIG. 22

Dielectric Constant vs. Temperature at 400 Cycles, Grade JP-3 Fuels

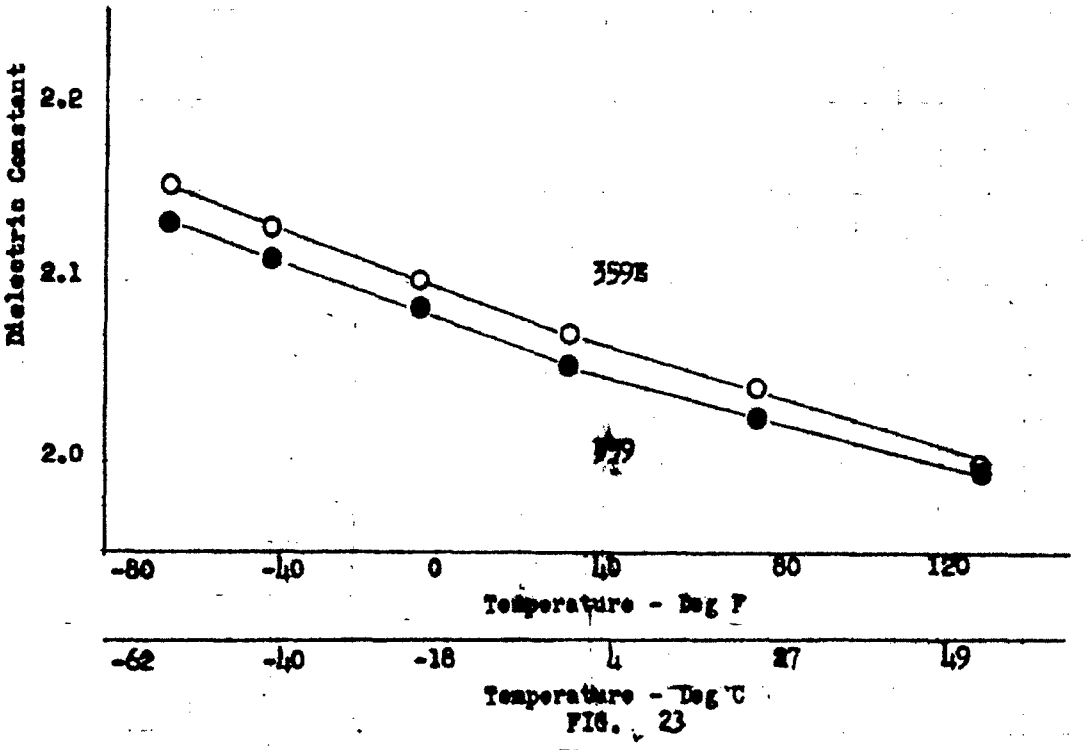


FIG. 23

Dielectric Constant vs. Temperature at 400 Cycles, Grade JP-3 Fuels

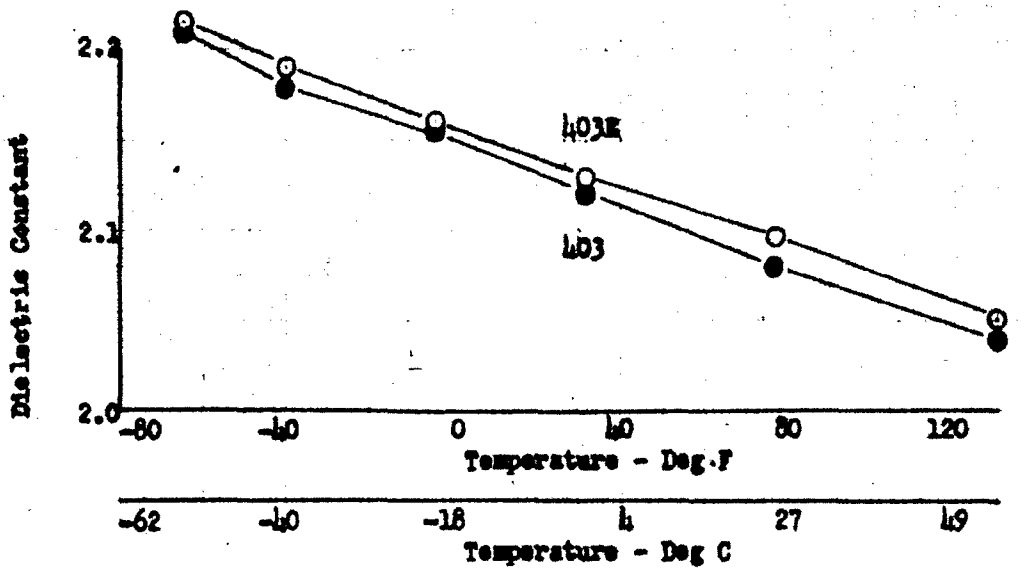


FIG. 24

Dielectric Constant vs. Temperature at 400 Cycles, Grade JP-3 Fuels

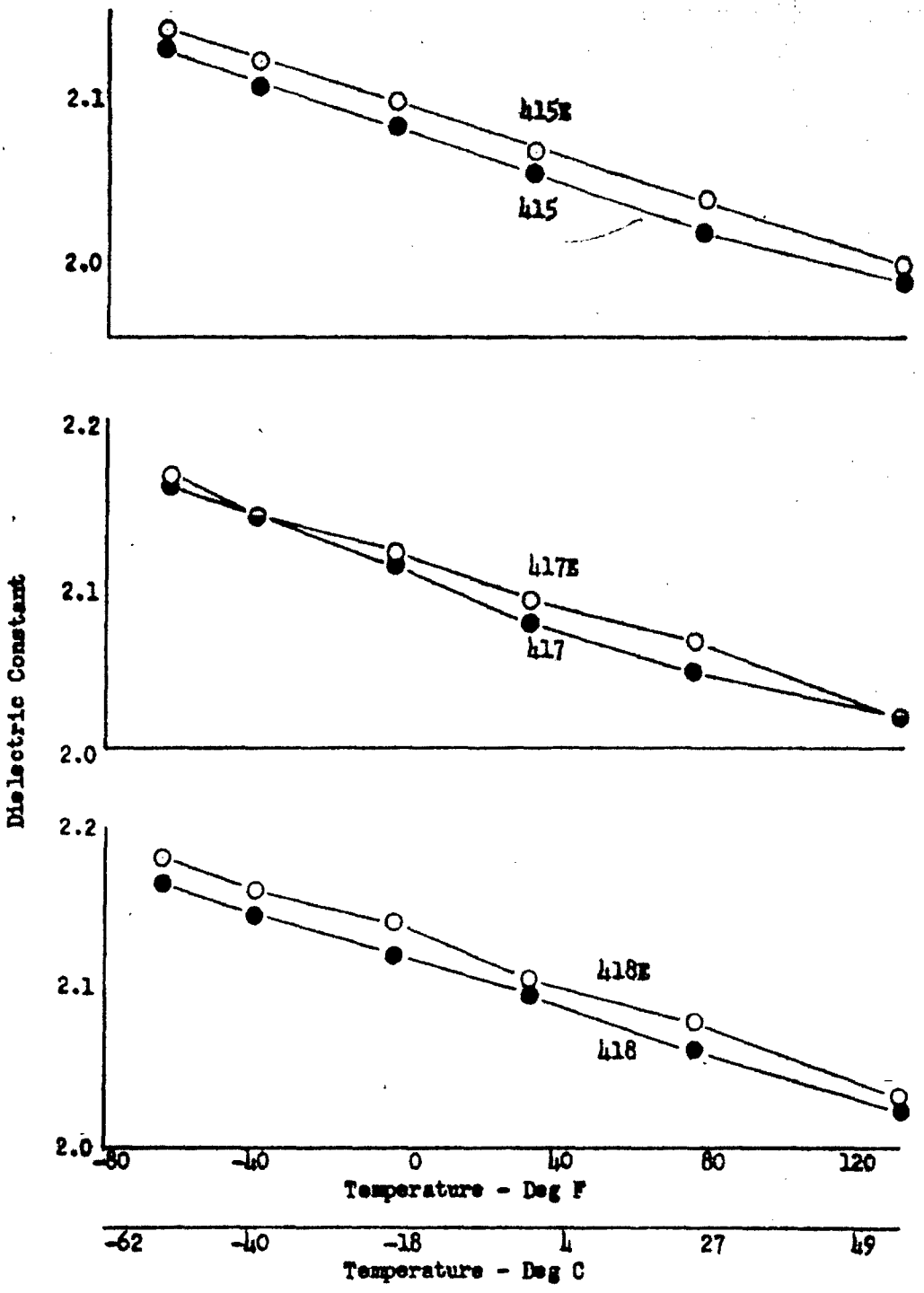


FIG. 25

Dielectric Constant vs. Temperature at 400 Cycles, Grade JP-4 Fuels

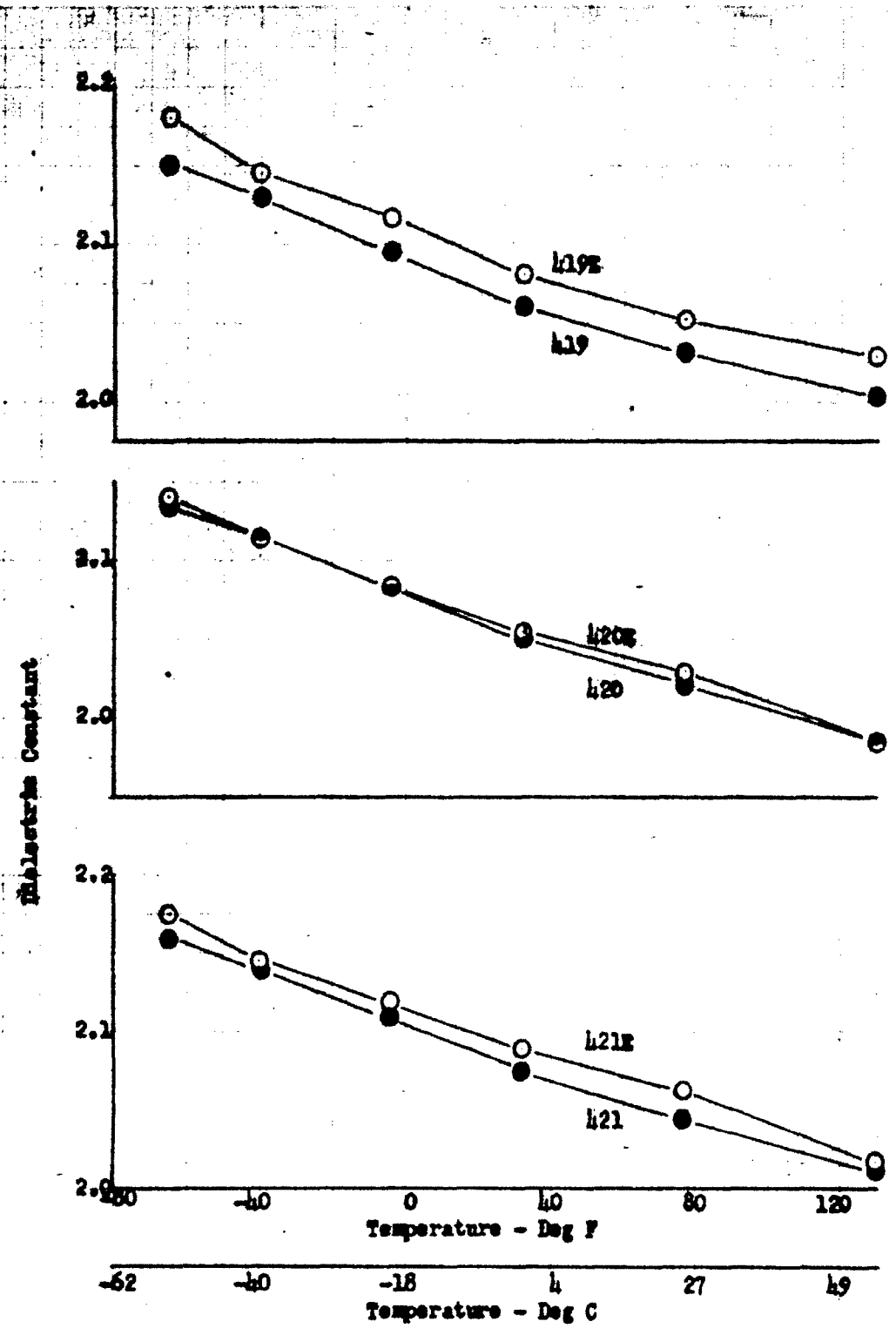


FIG. 26

Dielectric Constant vs. Temperature at 400 Cycles, Grade JP-4 Fuels

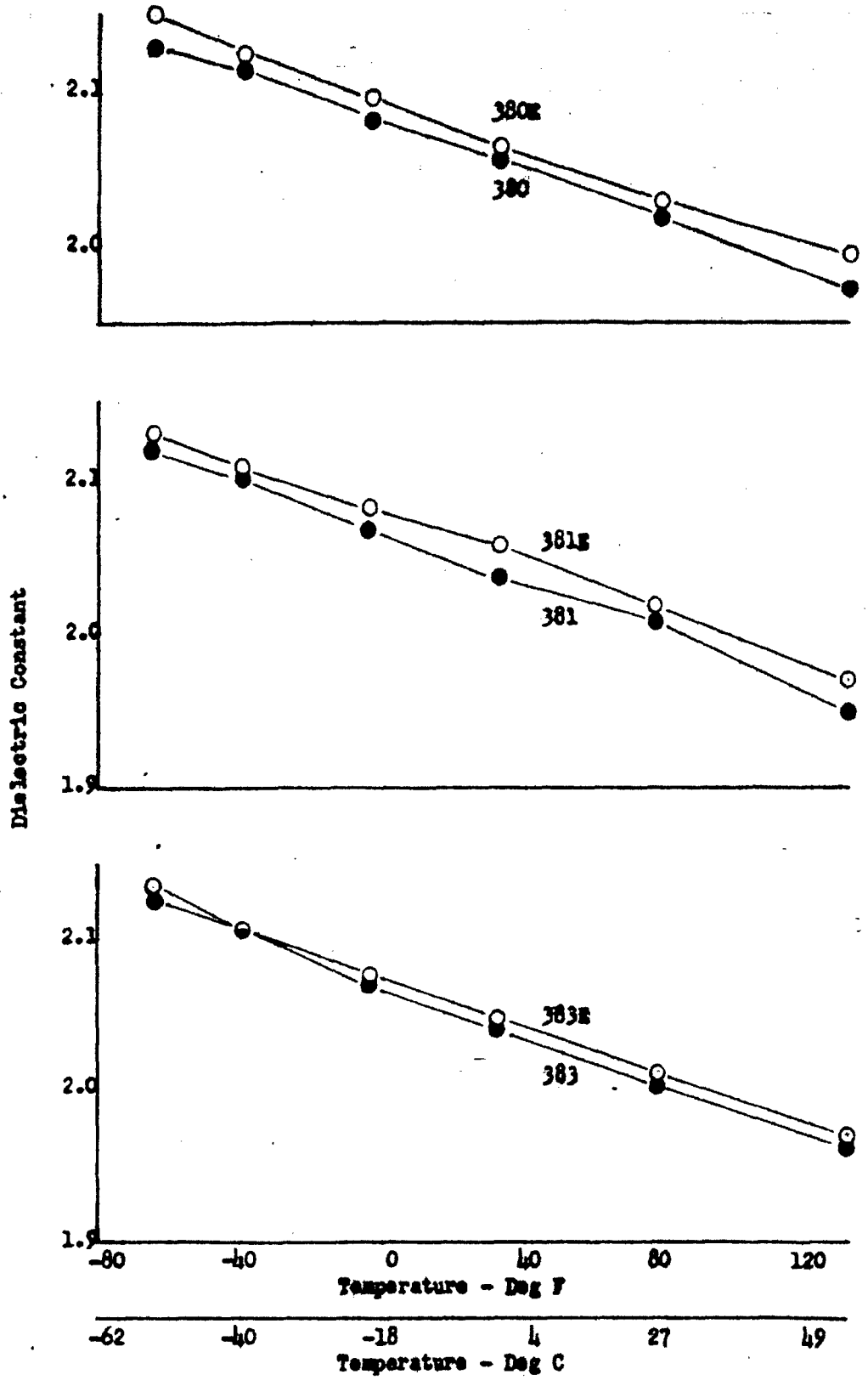


FIG. 27

Dielectric Constant vs. Temperature at 400 Cycles, Experimental Fuels

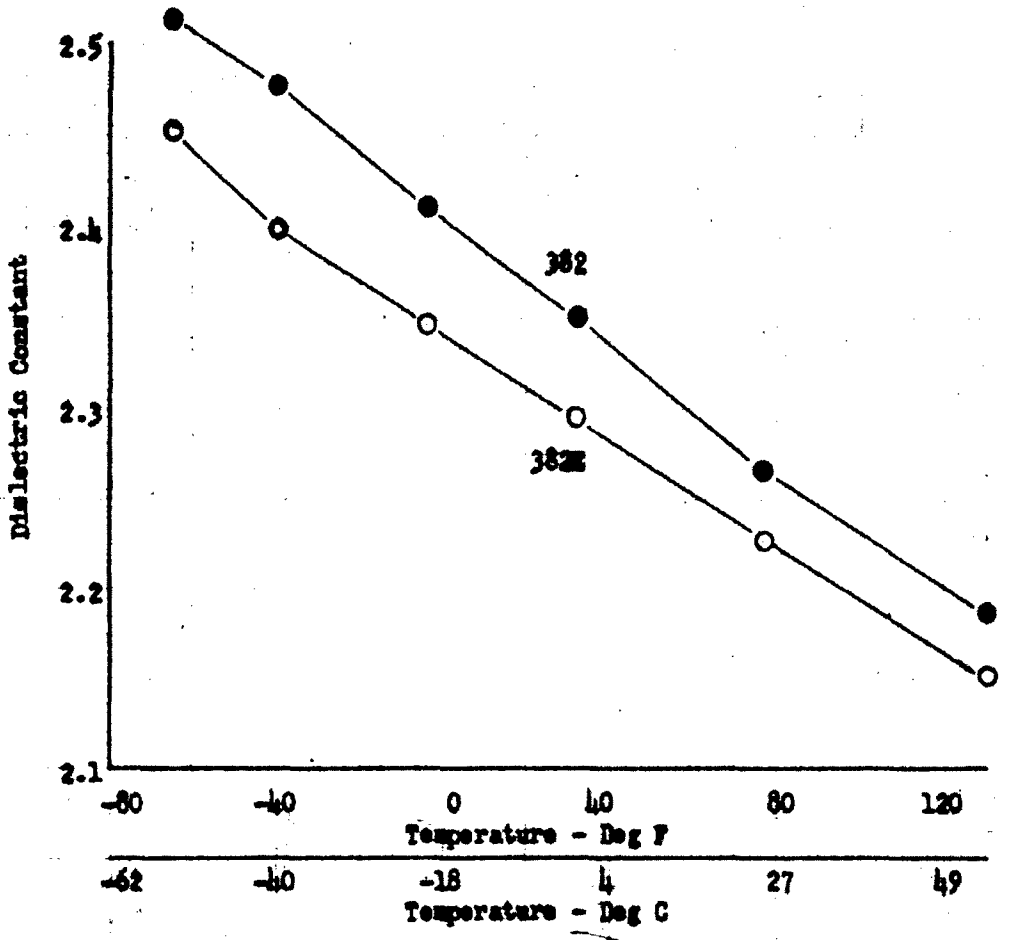


FIG. 28

Dielectric Constant vs. Temperature at 400 Cycles, Experimental Fuels

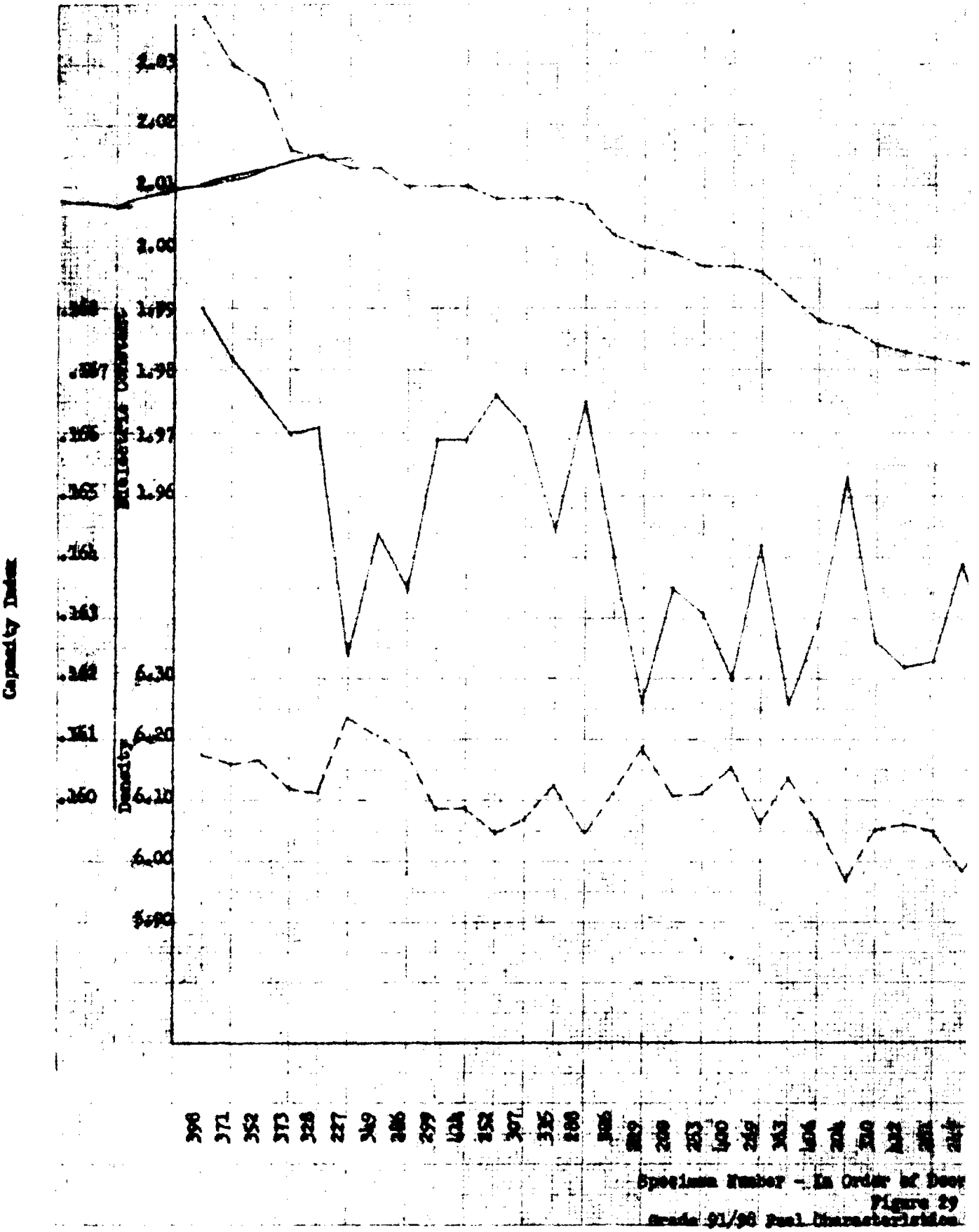
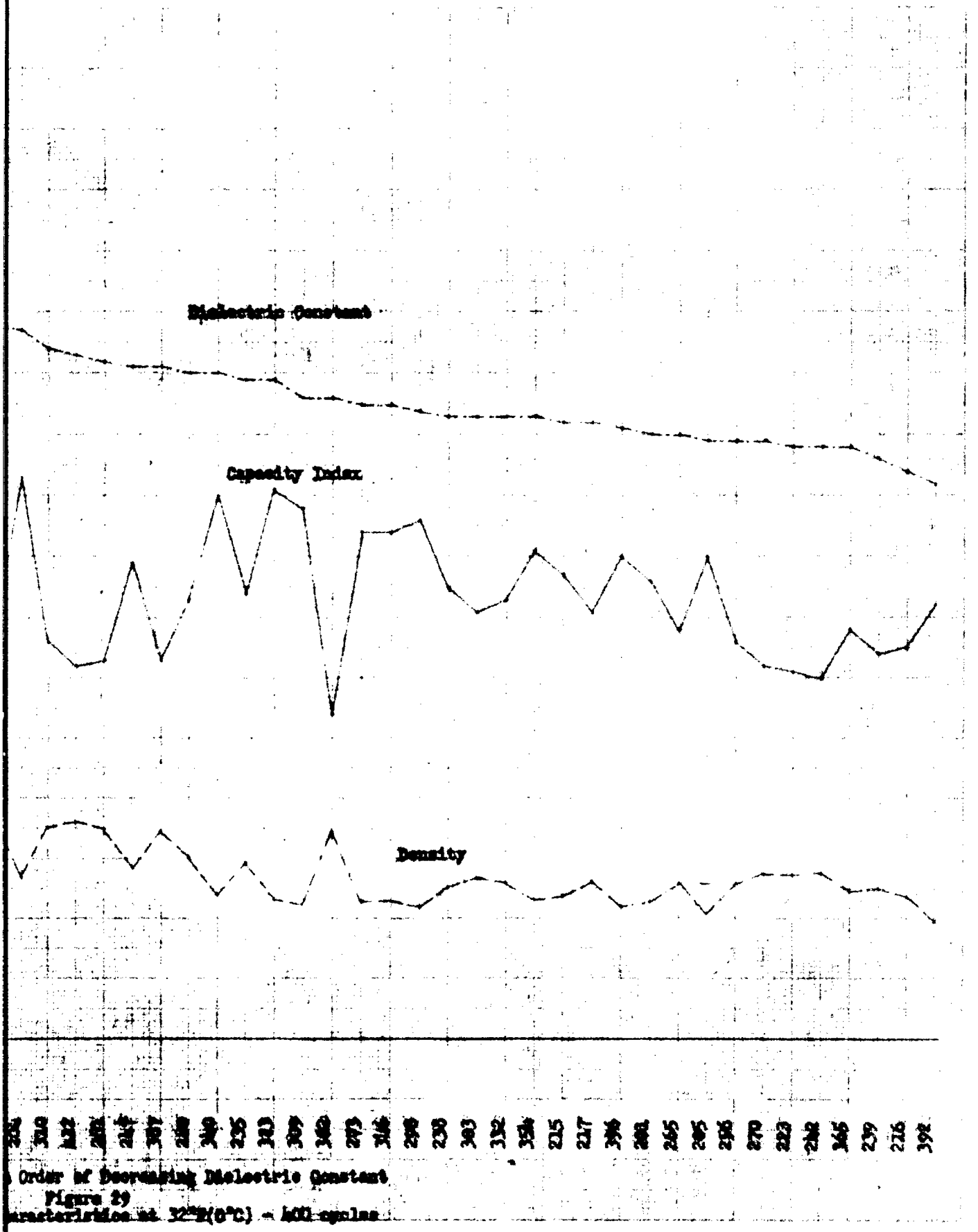


Figure 29

Grade 91/98 Foal Characterization

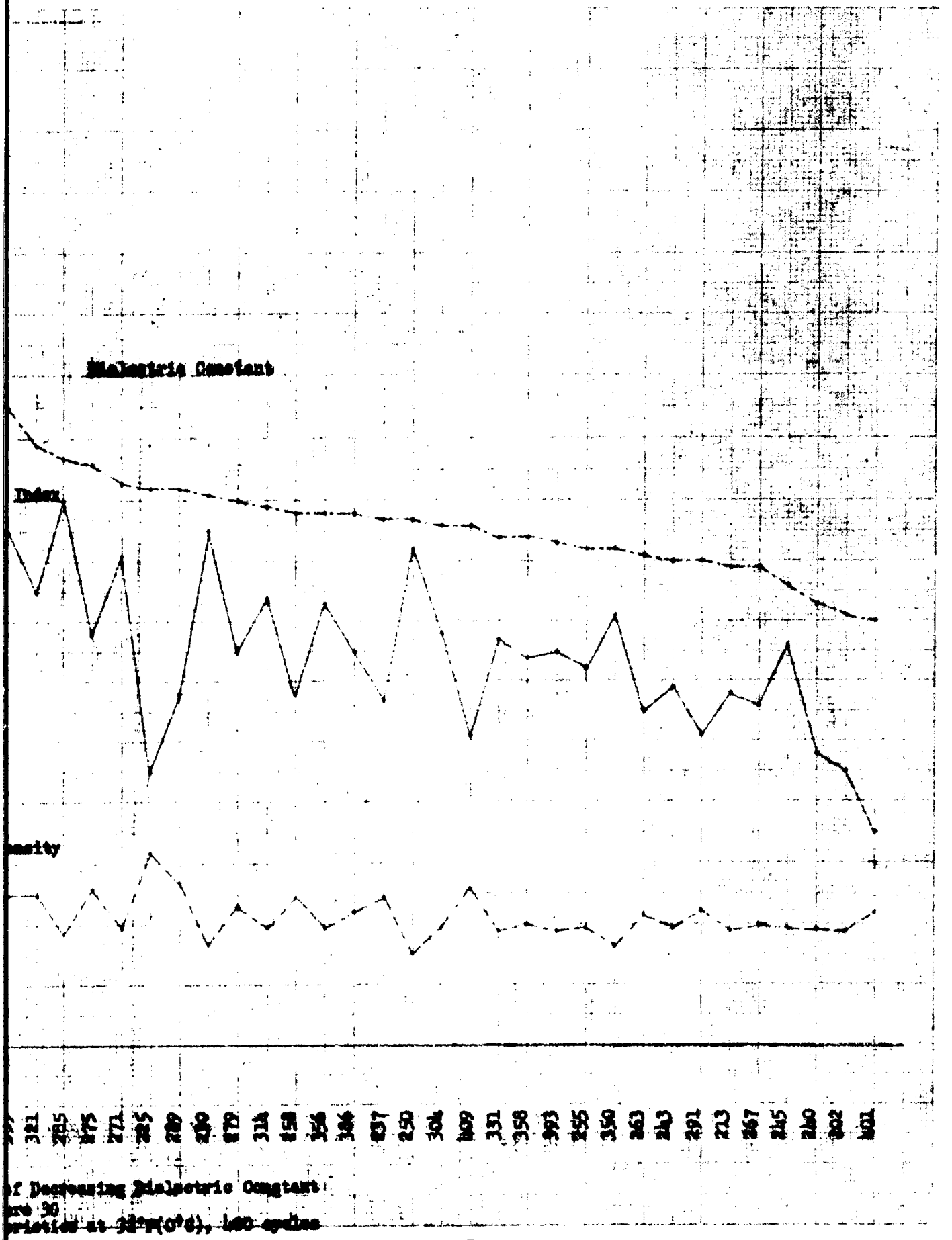


Order of Decreasing Dielectric Constant

Figure 29

Characteristics at 32°F(0°C) - 400 cycles

2



f Decreasing Dielectric Constant
re 30
ristics at 32°F(0°C), 400 cycles

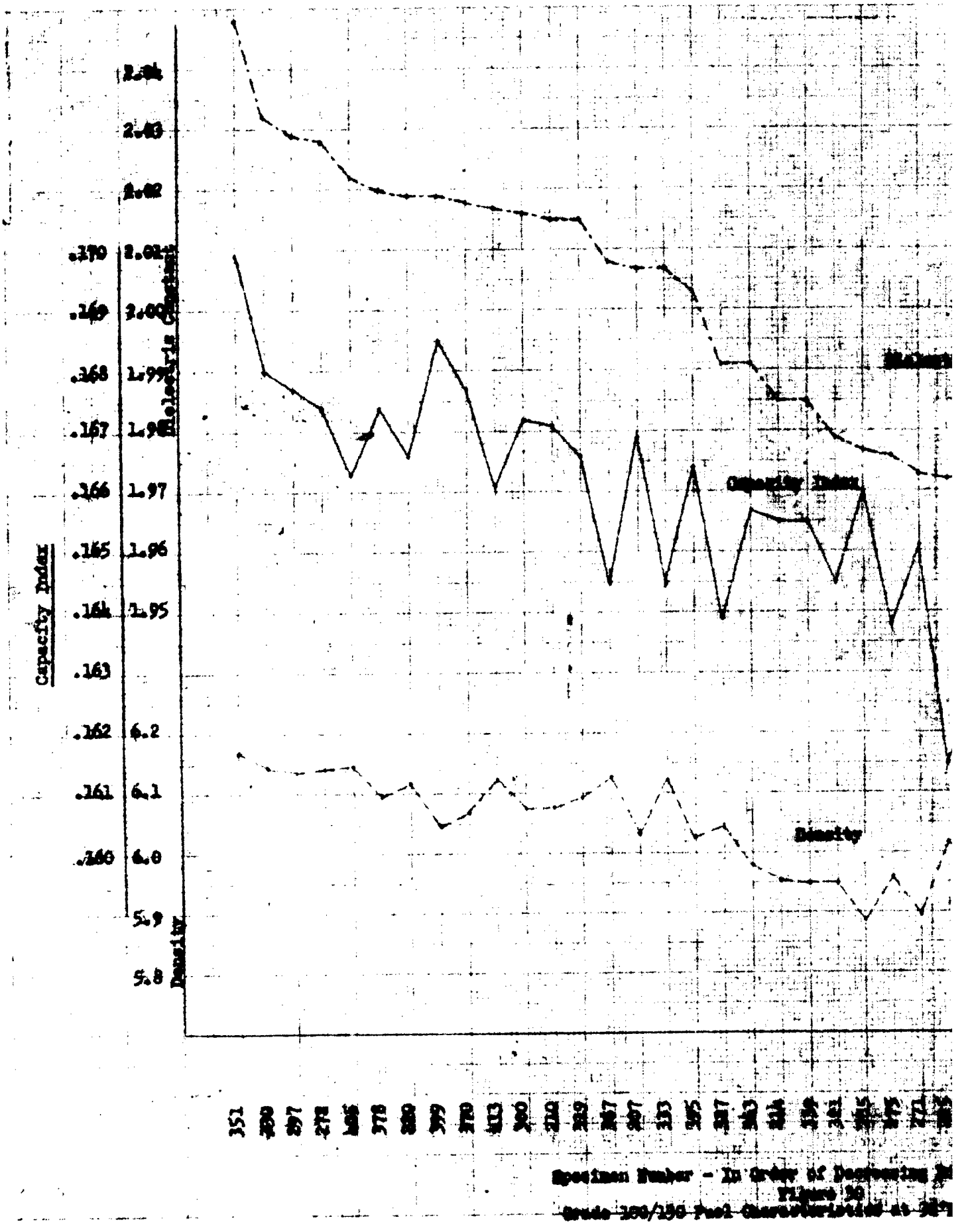
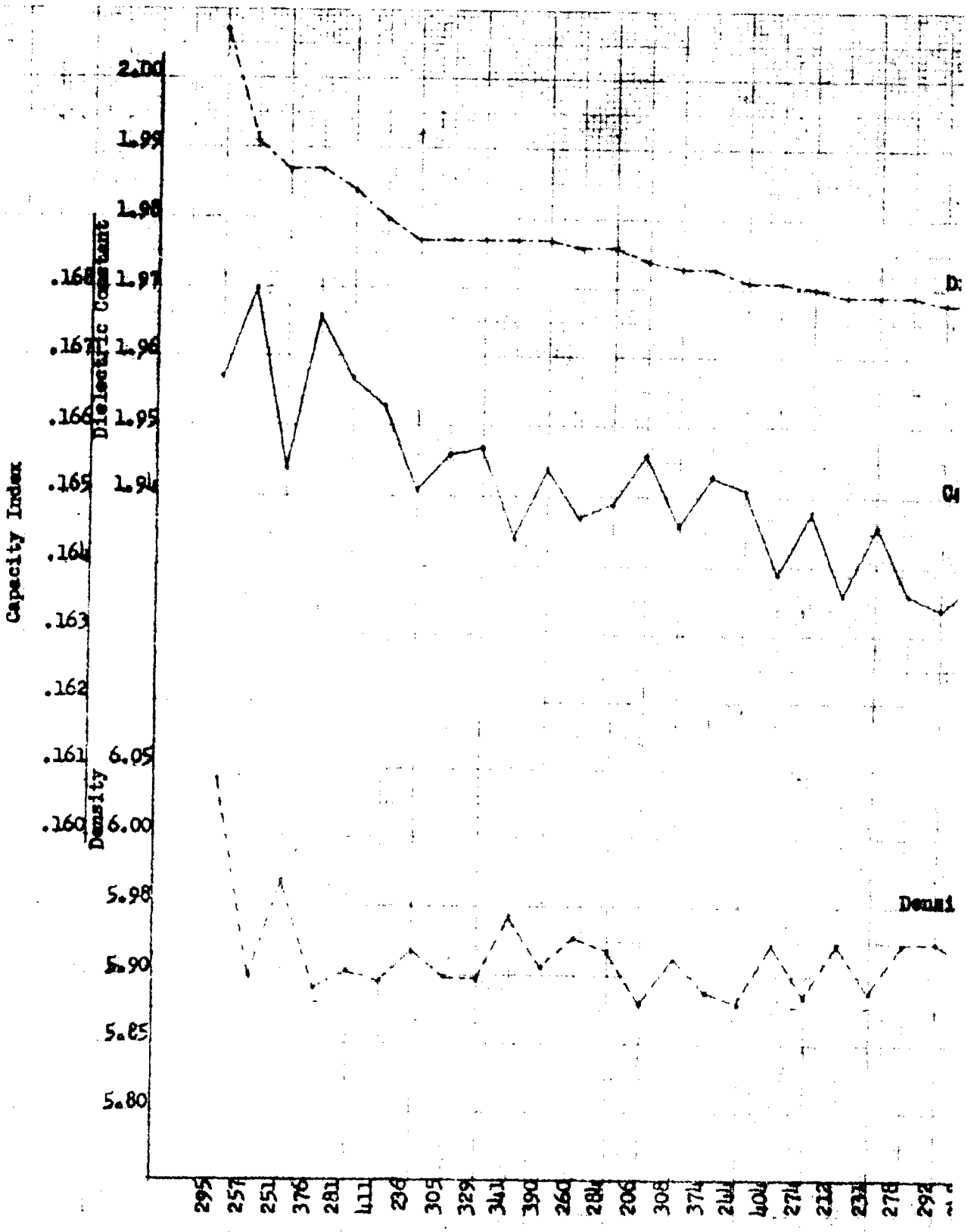


Figure 20

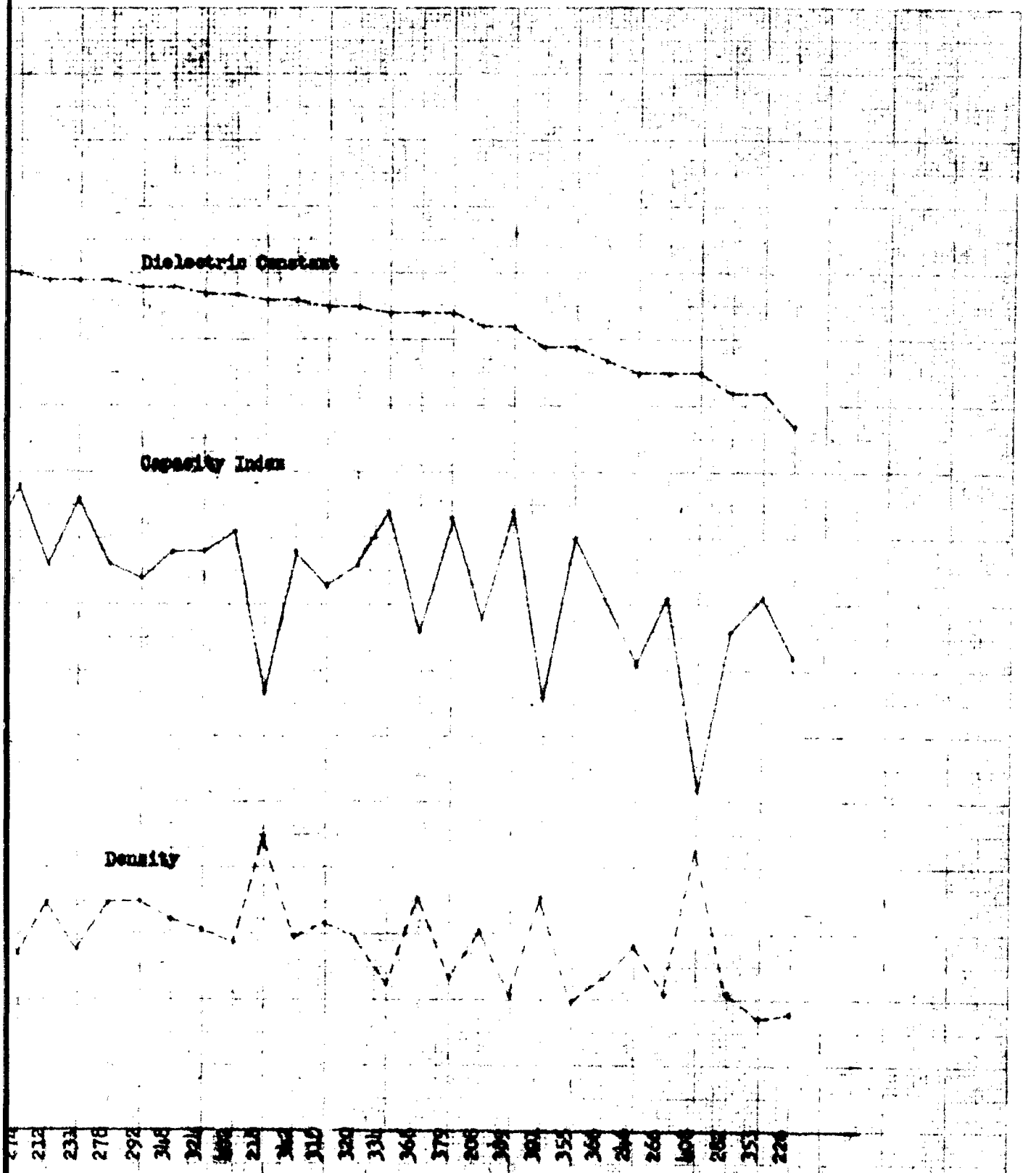
Crude 100/150 Fuel Characteristics as Set



Specimen Number - In Order of Decrea

Figure 31

Grade 115/145 Post Characteristics

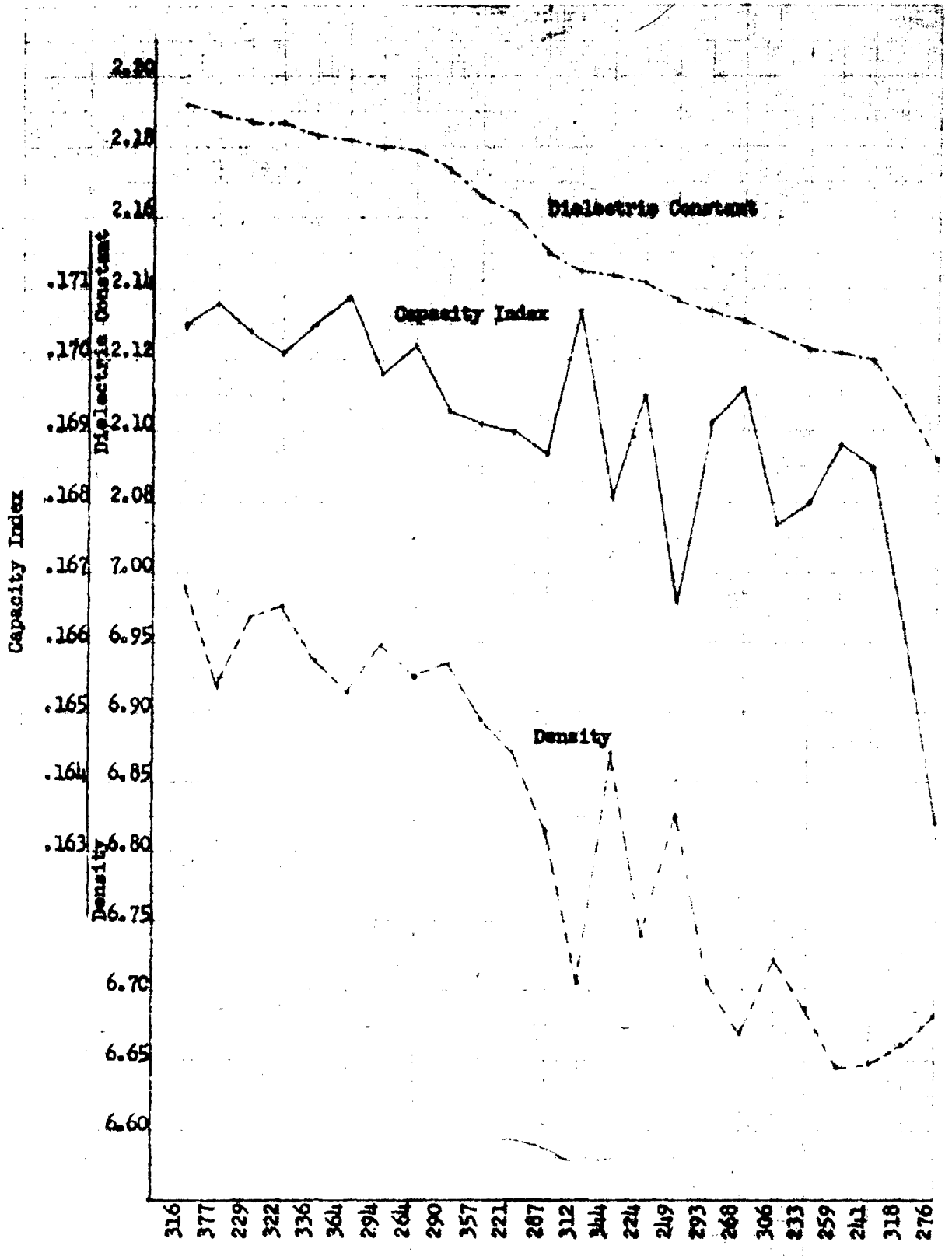


Order of Decreasing Dielectric Constant

Figure 31

haracteristics at 32°F(0°C), 400 cycles

(2)



Specimen Number - In order of Decreasing Dielectric Constant

Figure 32

Grade JP-1 Fuel Characteristics at 32°F(0°C)-400 Cycles

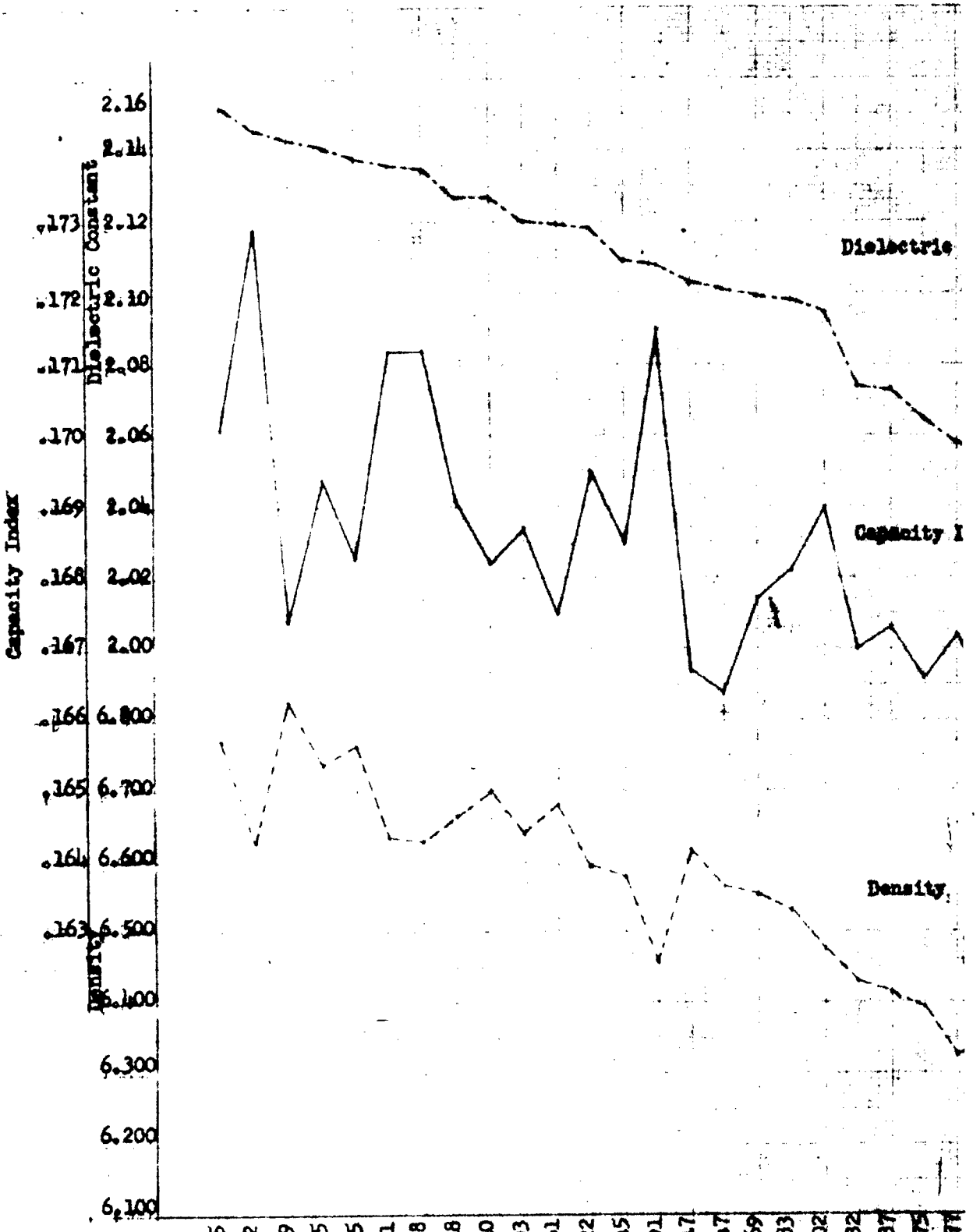
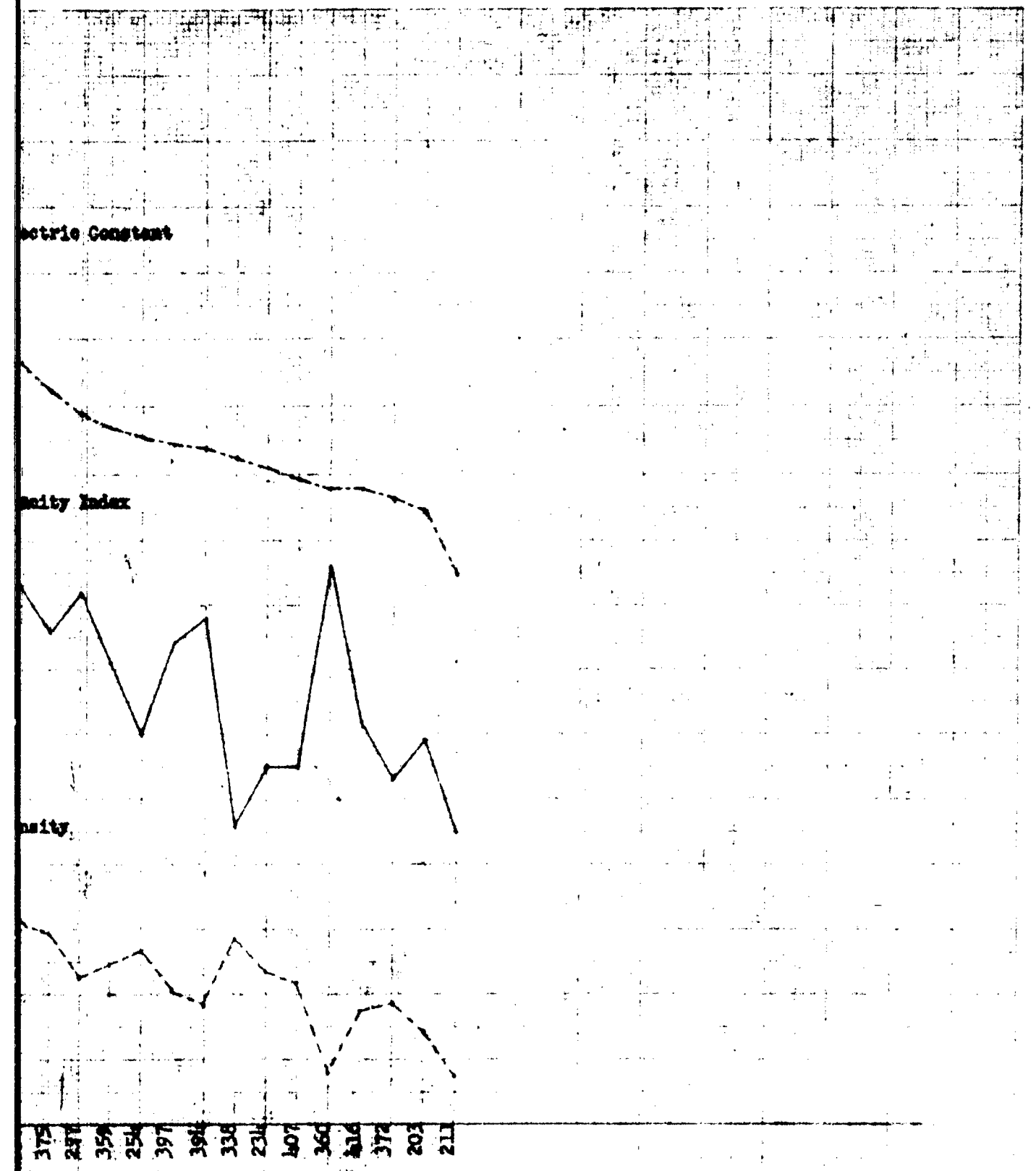
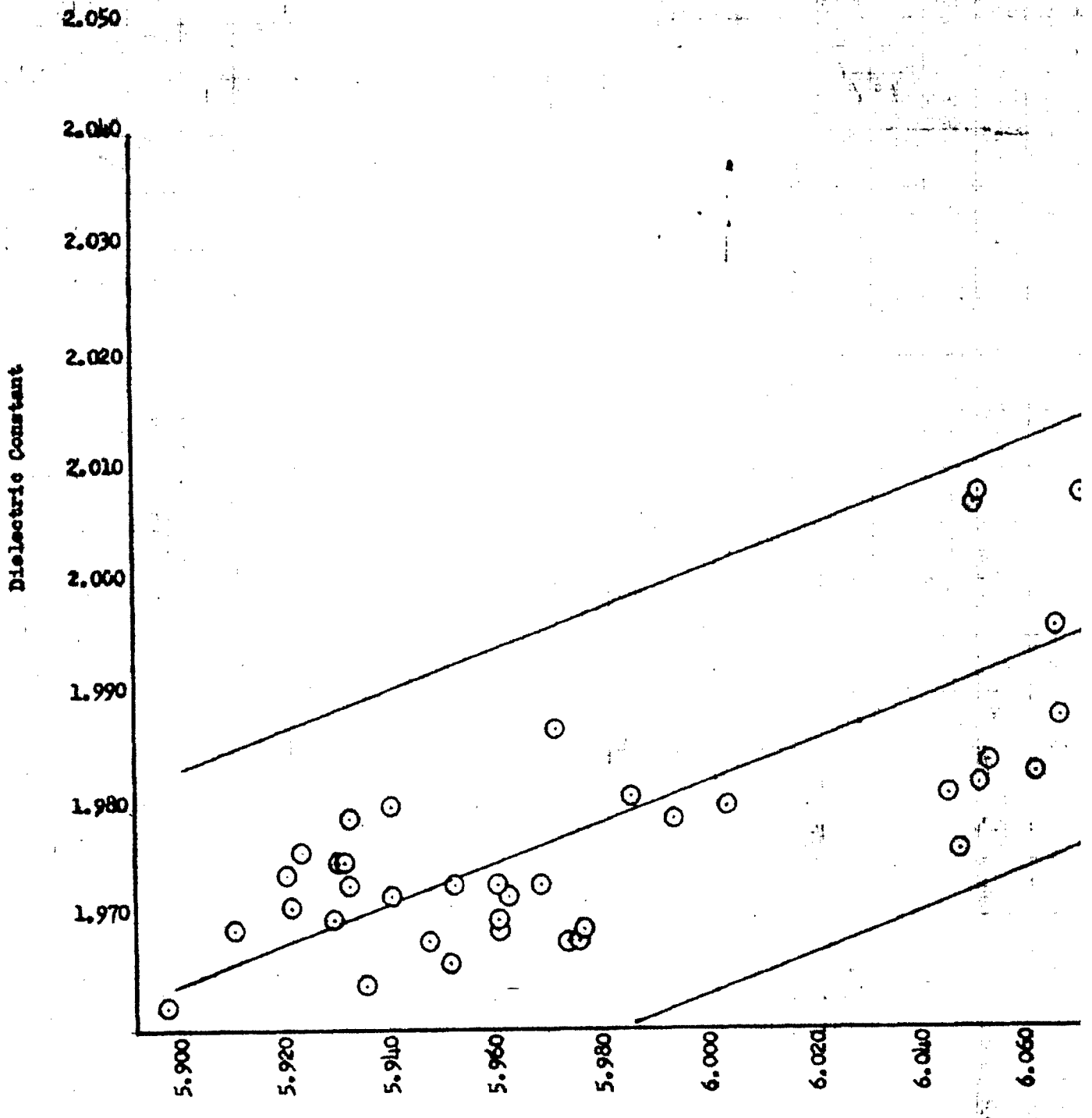


Figure 33

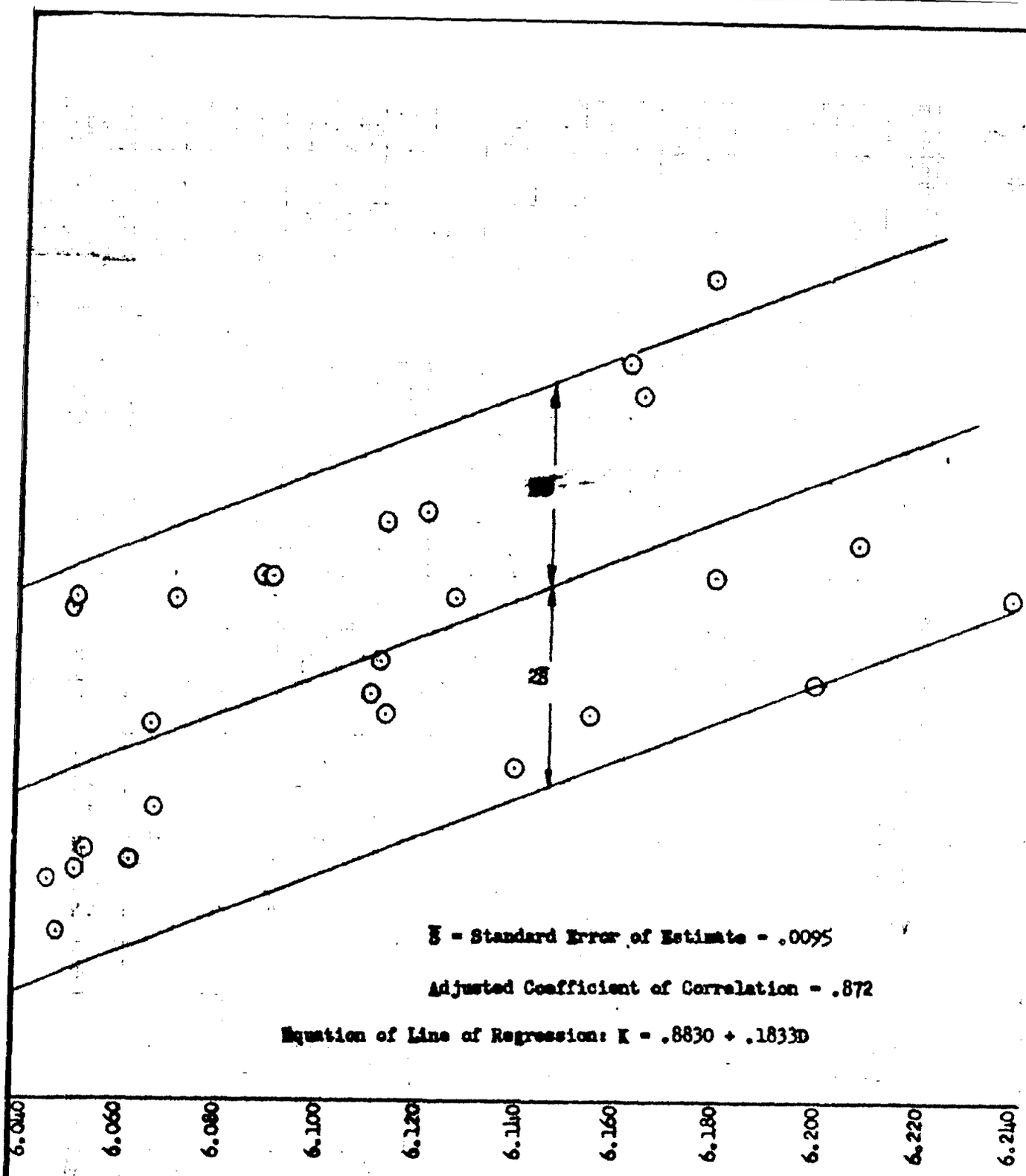
Grade JP-3 Fuel Characteristics at


ctric Constant
sity Index
sity,
375
278
359
254
397
394
338
234
107
360
316
372
203
211
creasing Dielectric Constant
53
es at 32°F(0°C), 400 cycles

(2)



Density -
Figu
Grade 91/98 Fuel Ch



$\bar{S}$ = Standard Error of Estimate = .0095

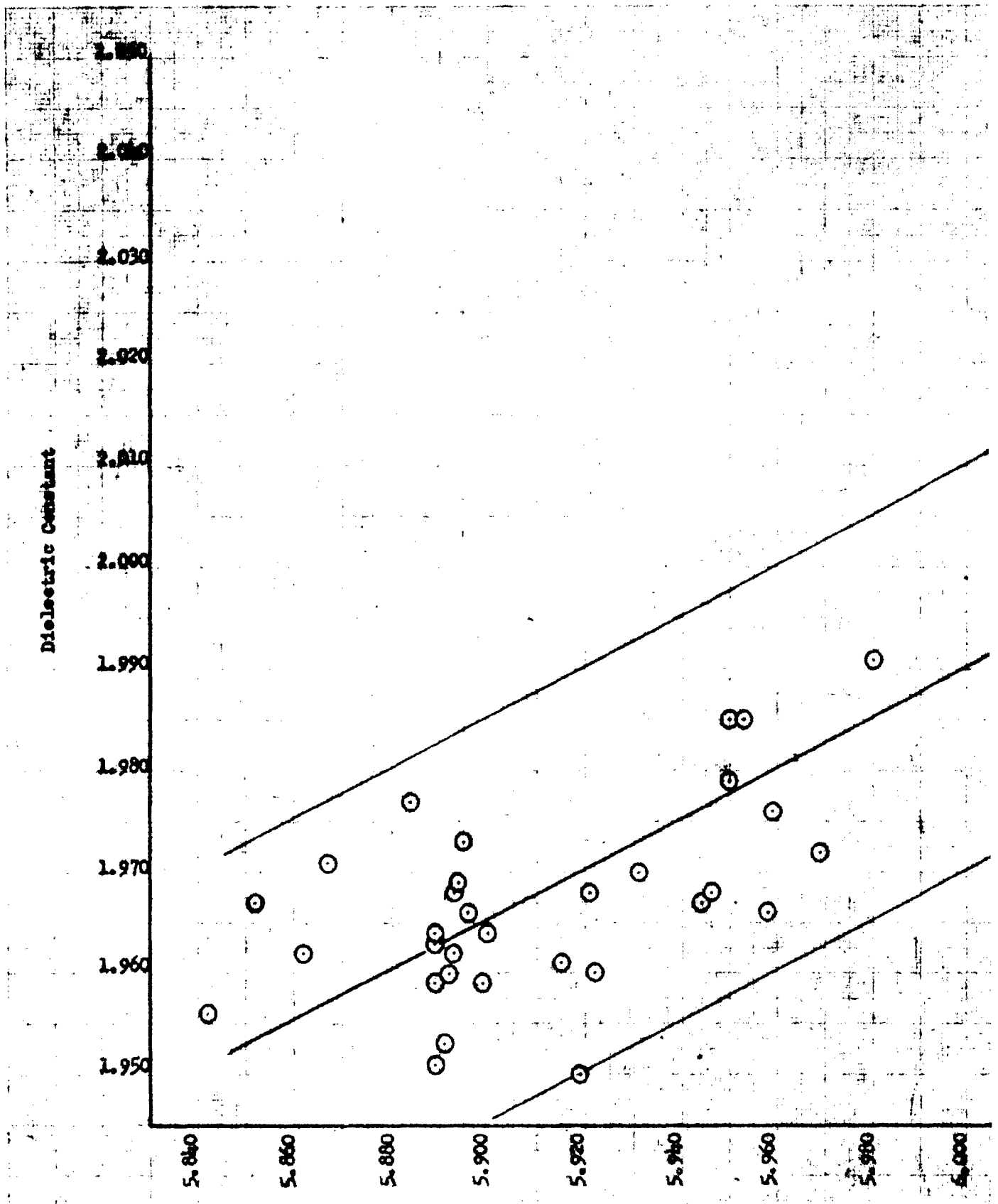
Adjusted Coefficient of Correlation = .872

Equation of Line of Regression: K = .8830 + .1833D

Density - Lb/Gallon

Figure 34

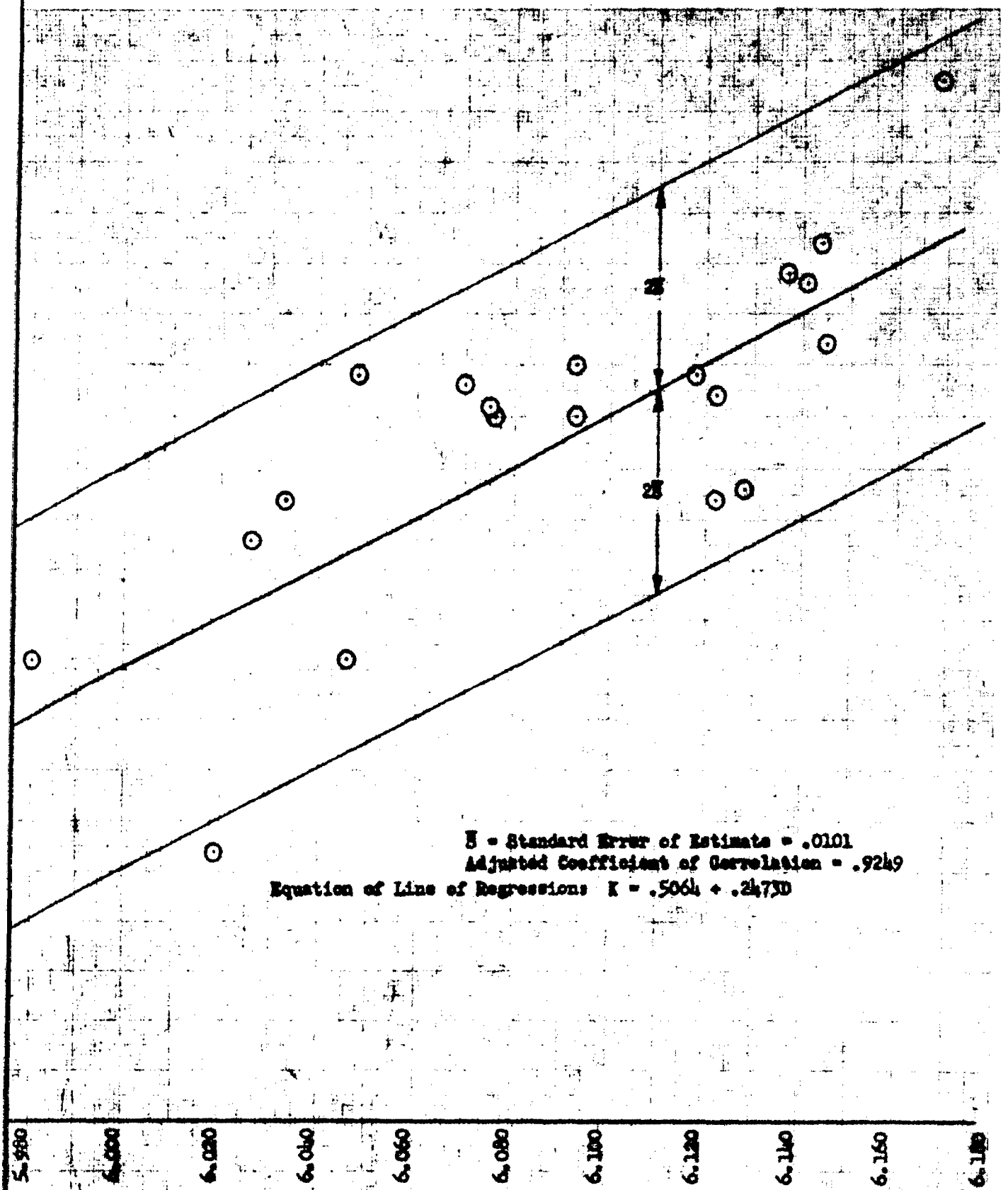
91/98 Fuel Characteristics at 32°F(0°C), 400 cycles



Density - lb

Figure 3

Grade 100/130 Fuel Characteristi



E = Standard Error of Estimate = .0101
Adjusted Coefficient of Correlation = .9249
Equation of Line of Regression: K = .5064 + .2473D

5.980 6.000 6.020 6.040 6.060 6.080 6.100 6.120 6.140 6.160 6.180

Density - lb/Gallon

Figure 35
Characteristics at 32°F(0°C), 400 Cycles

(2)

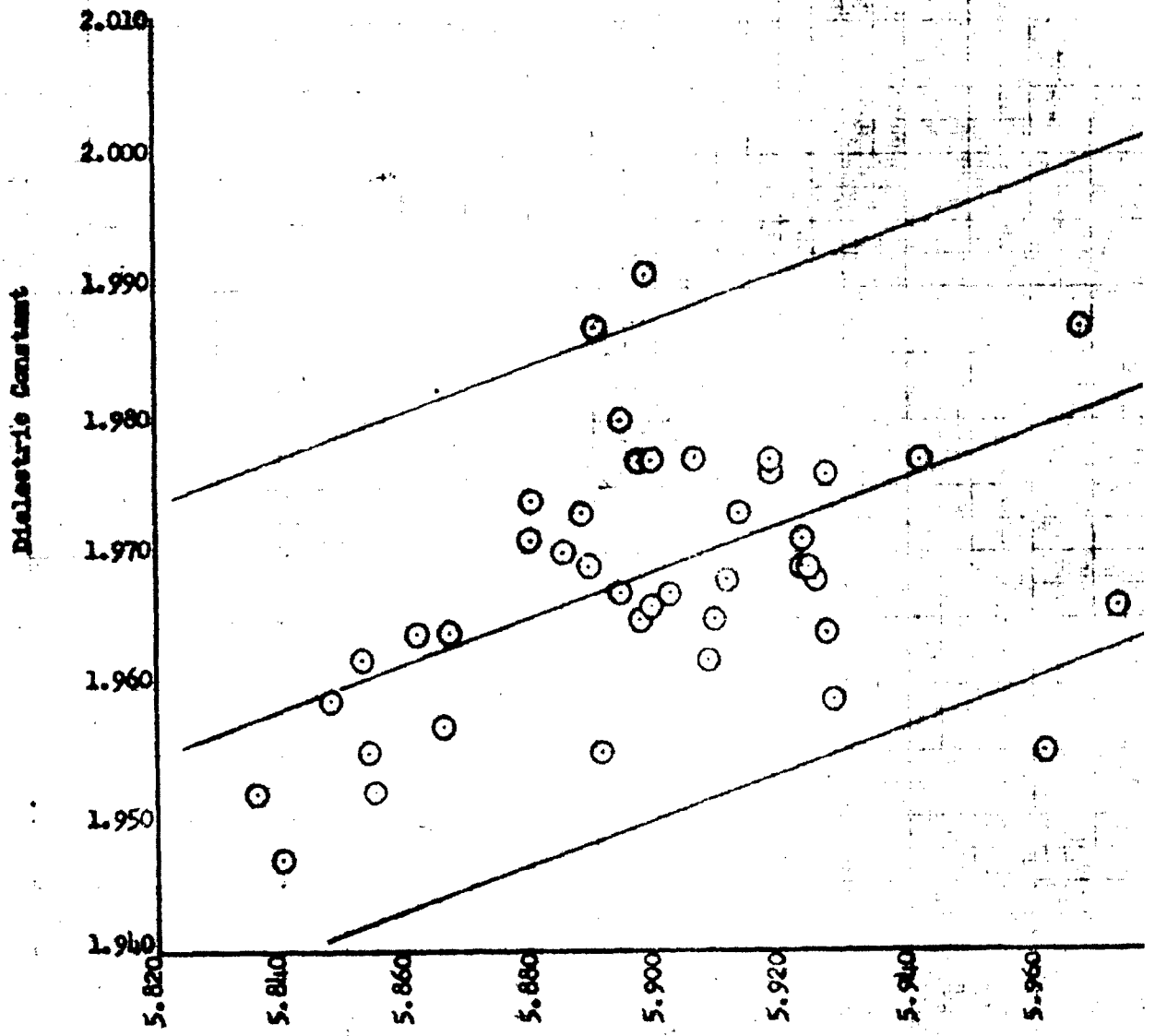
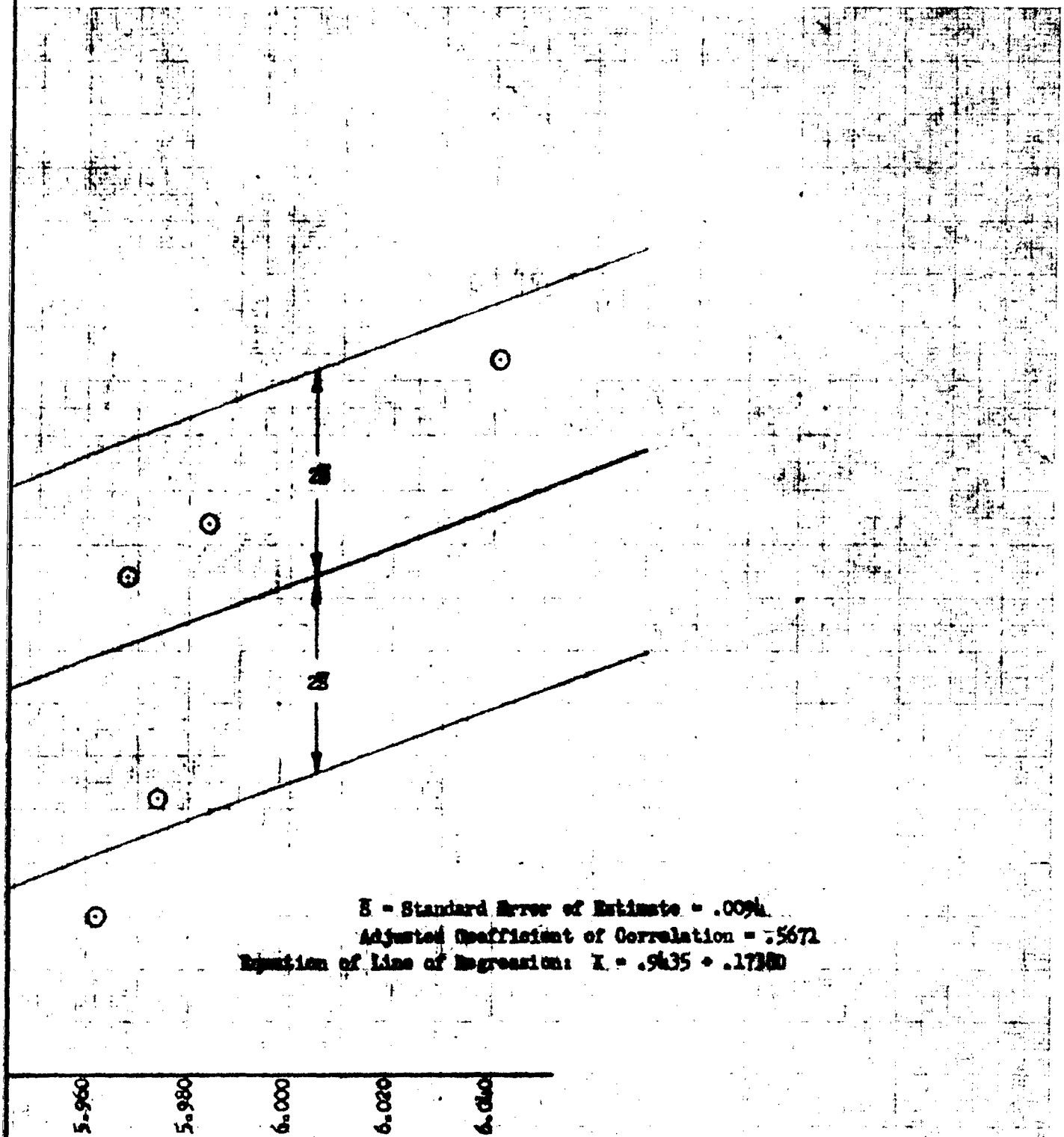


Figure 36

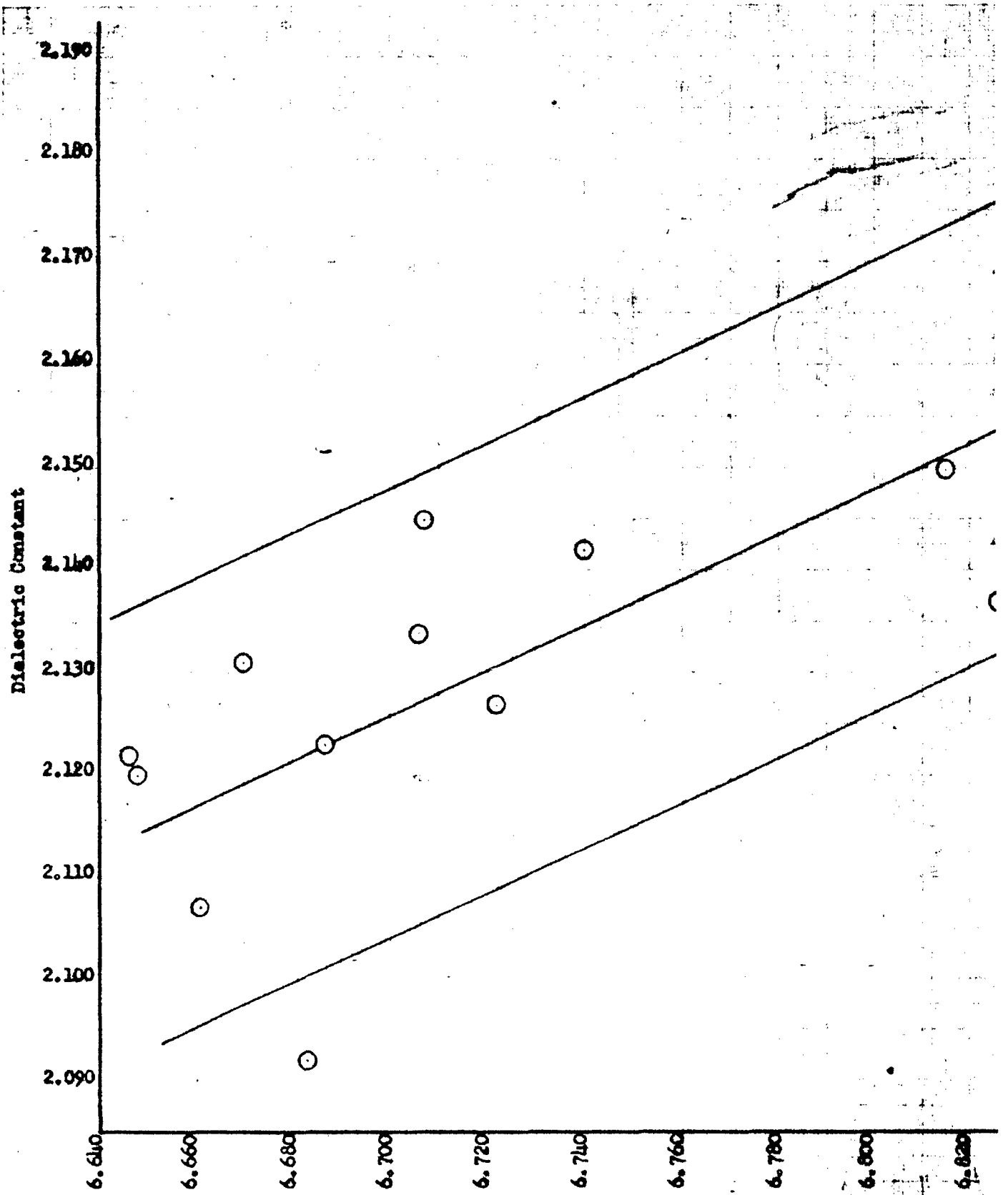
Grade 115/145 Fuel Characteristics at 32°F(



S = Standard Error of Estimate = .009h
Adjusted Coefficient of Correlation = .5671
Equation of Line of Regression: X = .9h35 + .17h0

5.960 5.980 6.000 6.020 6.040

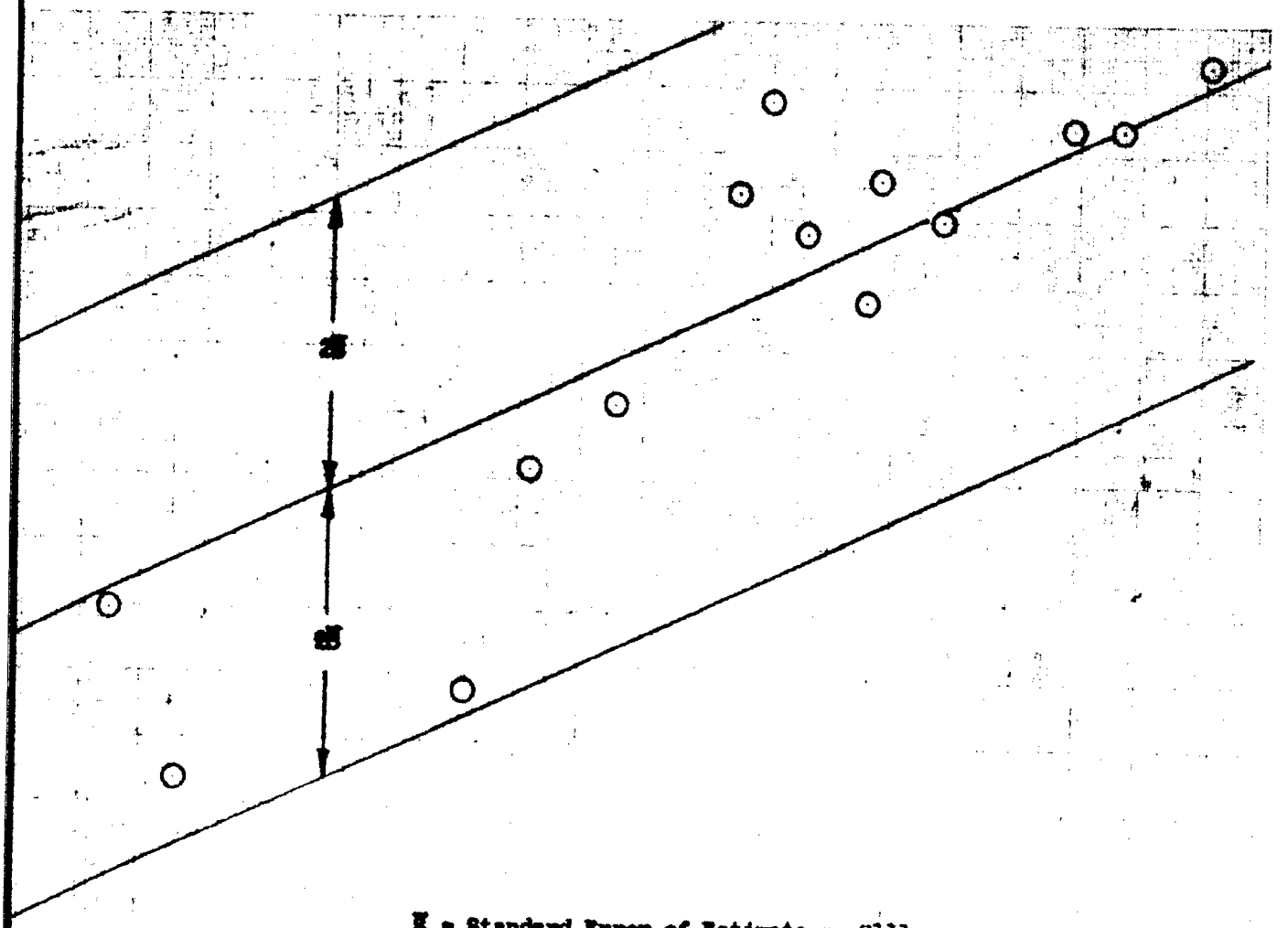
= Lb/Gallon
re 36
rtables at 32°F(0°C), 400 cycles



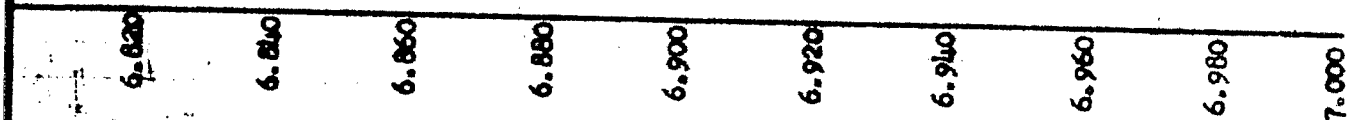
Density - lb/

Figure 3

Grade JP-1 Fuel Characteristics a



S = Standard Error of Estimate = .0111
Adjusted Coefficient of Correlation = .9258
Equation of Line of Regression: K = .6401 + .2217D

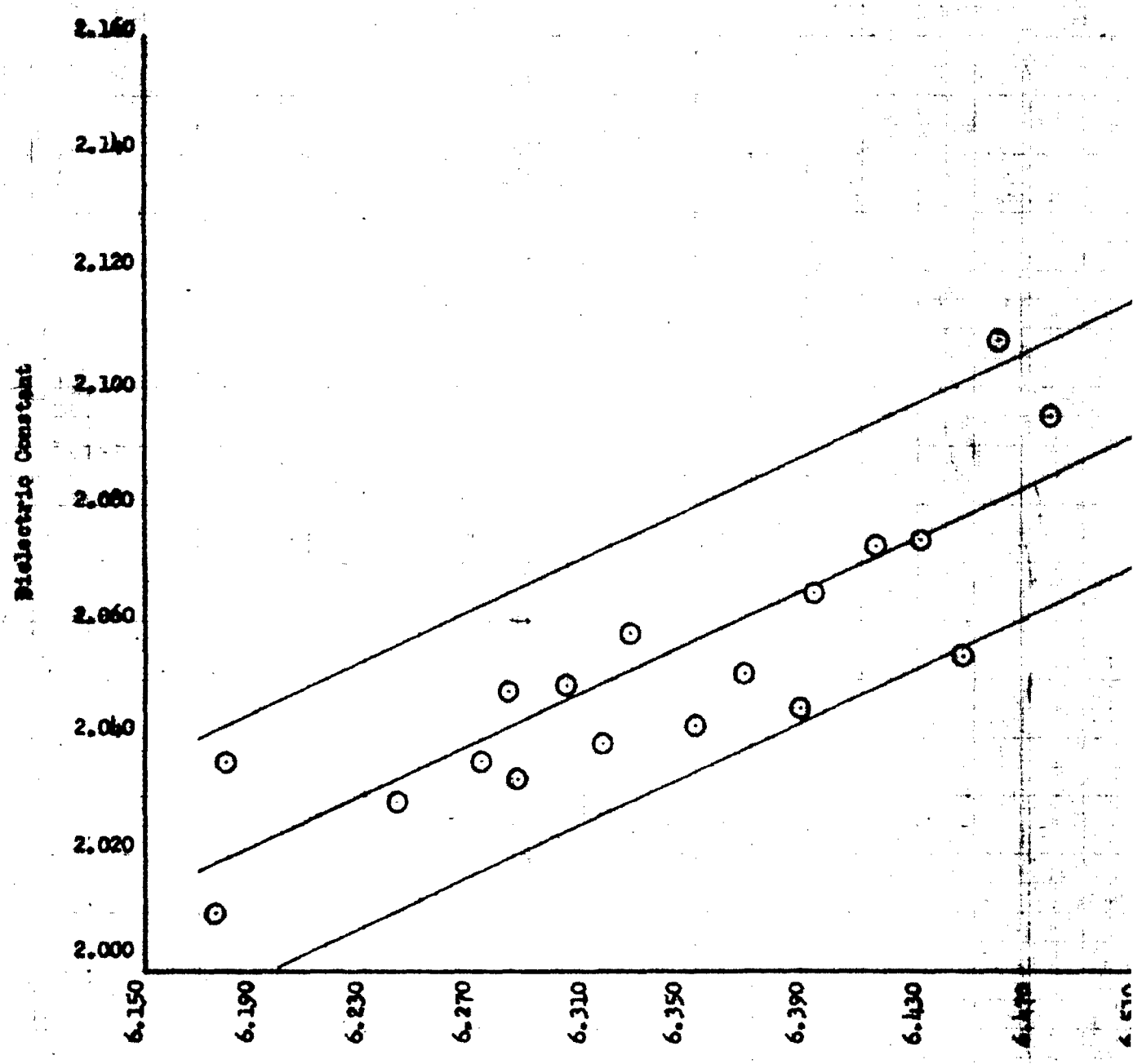


...sity - Lb/Gallon

Figure 37

...cteristics at 32°F(0°C), 400 cycles

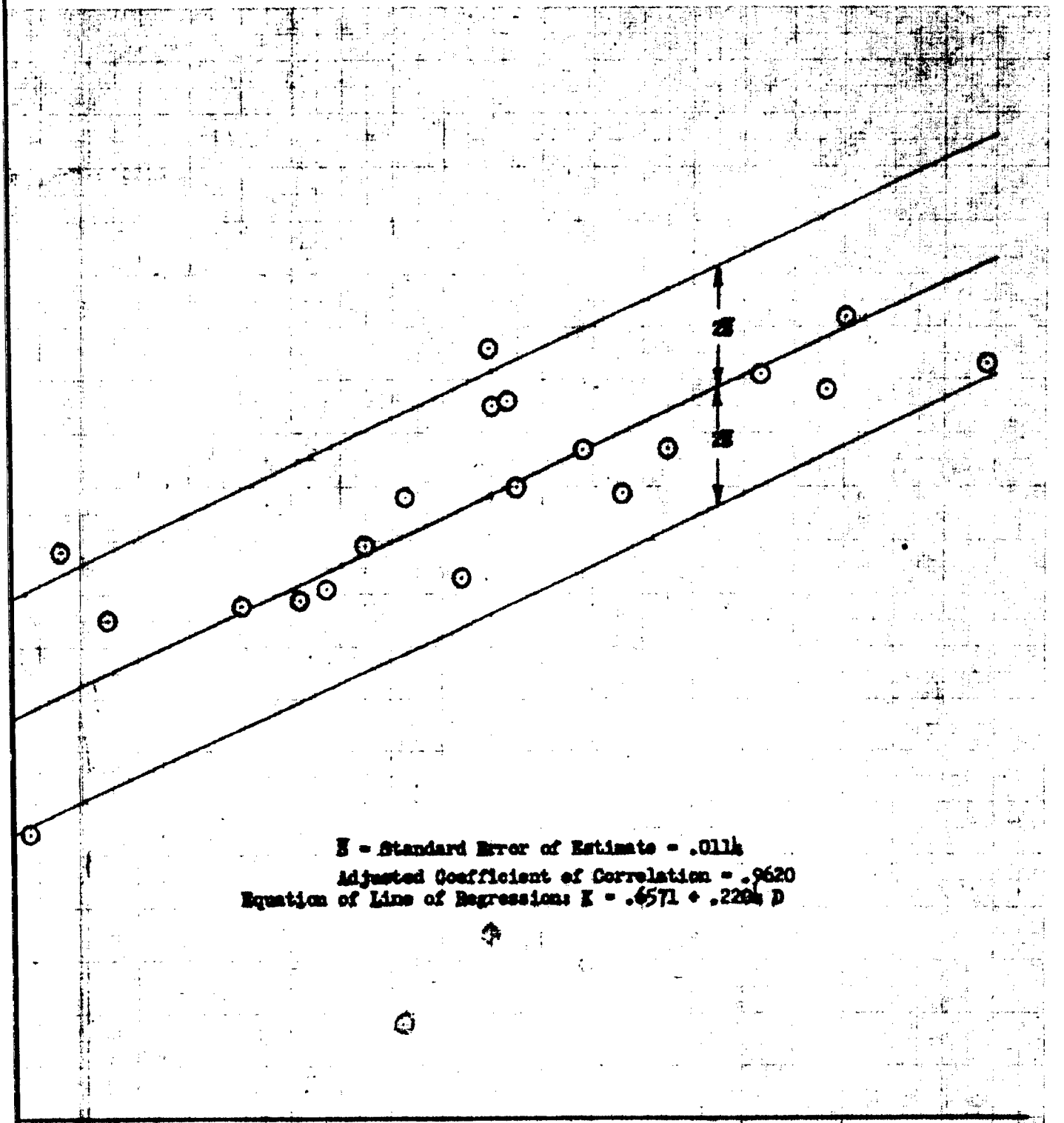
(2)



Density –

Fig

Grade JP-3 Fuel Characteristi



E = Standard Error of Estimate = .011k

Adjusted Coefficient of Correlation = .9620

Equation of Line of Regression: K = .4571 + .220k D

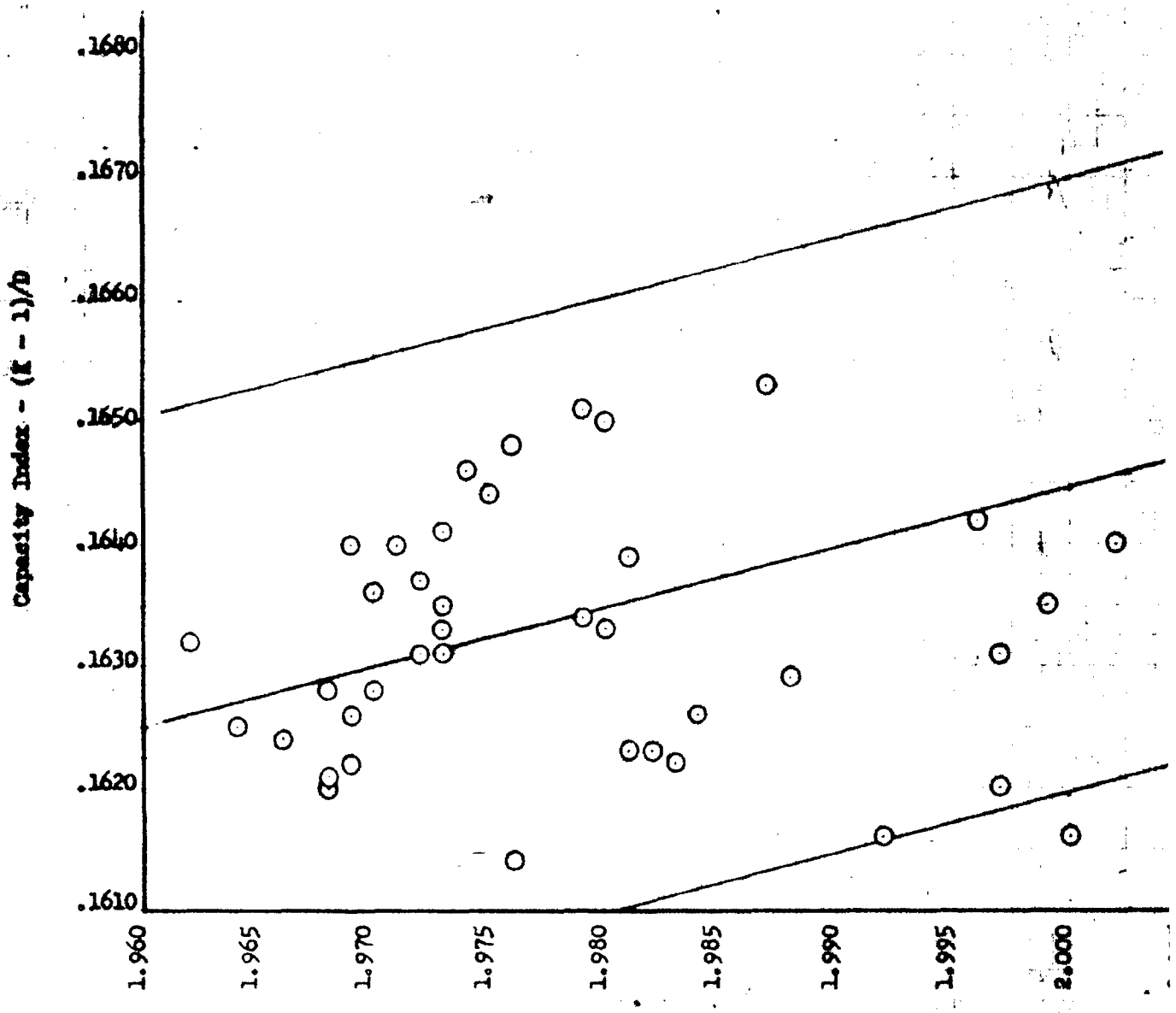
6.510 6.550 6.590 6.630 6.670 6.710 6.750 6.790 6.830

Density - Lb/Gallon

Figure 30

l Characteristics at 32°F(0°C), 400 cycles

(2)



Dielectr
Figu
Grade 91/98 Fuel Characteri

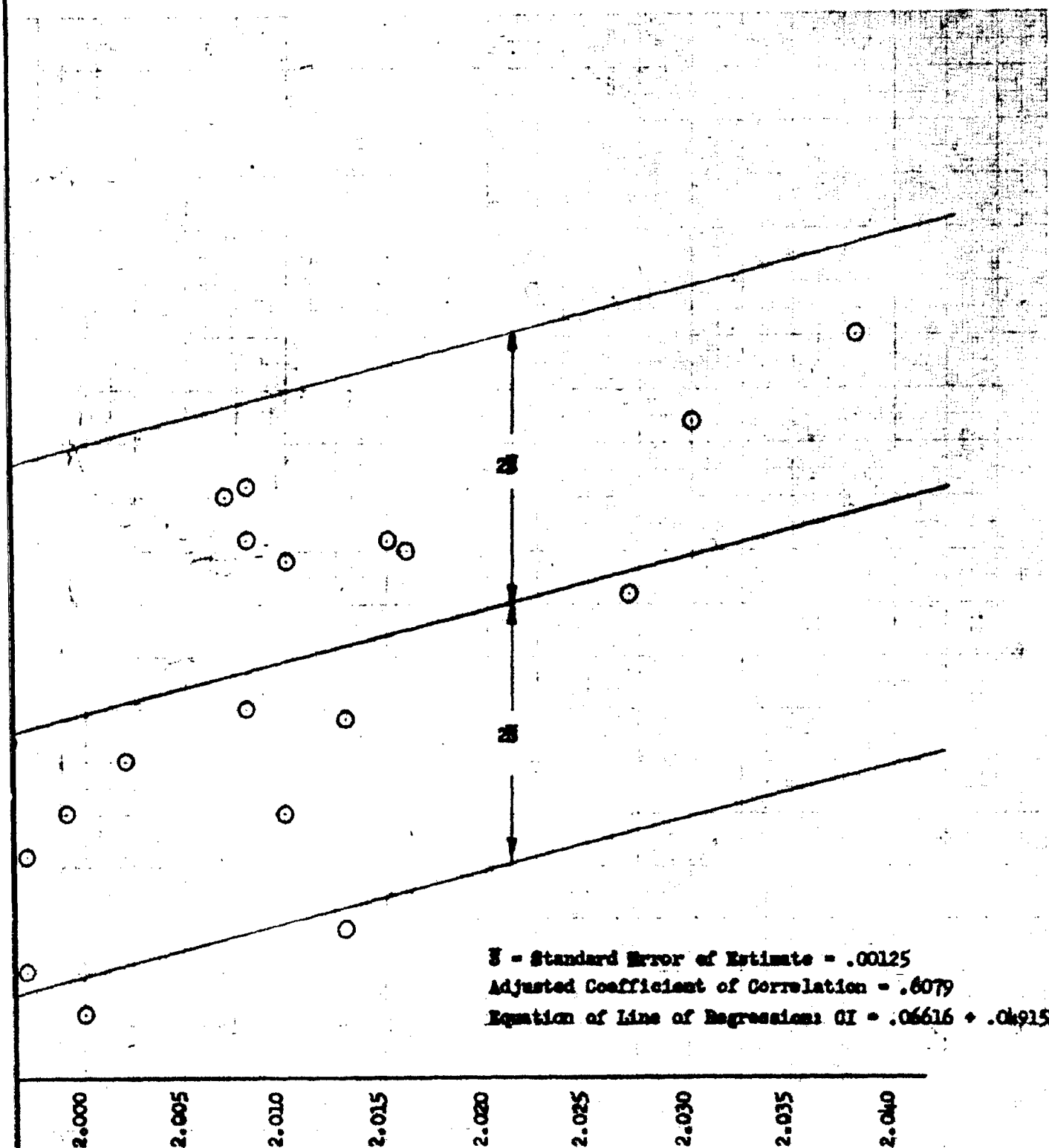
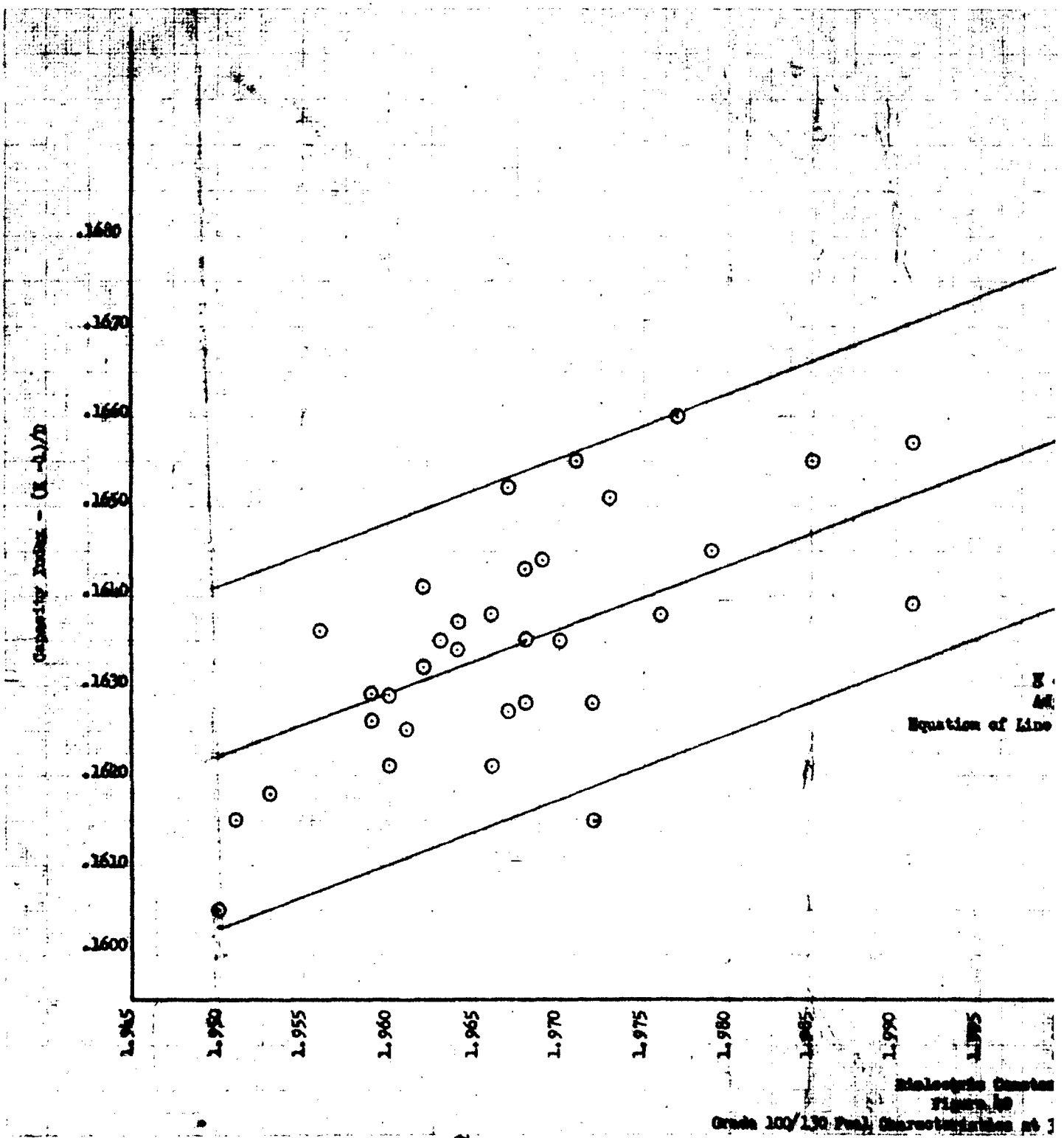


Figure 39

...ual Characteristics at 32°F(0°C), 400 cycles

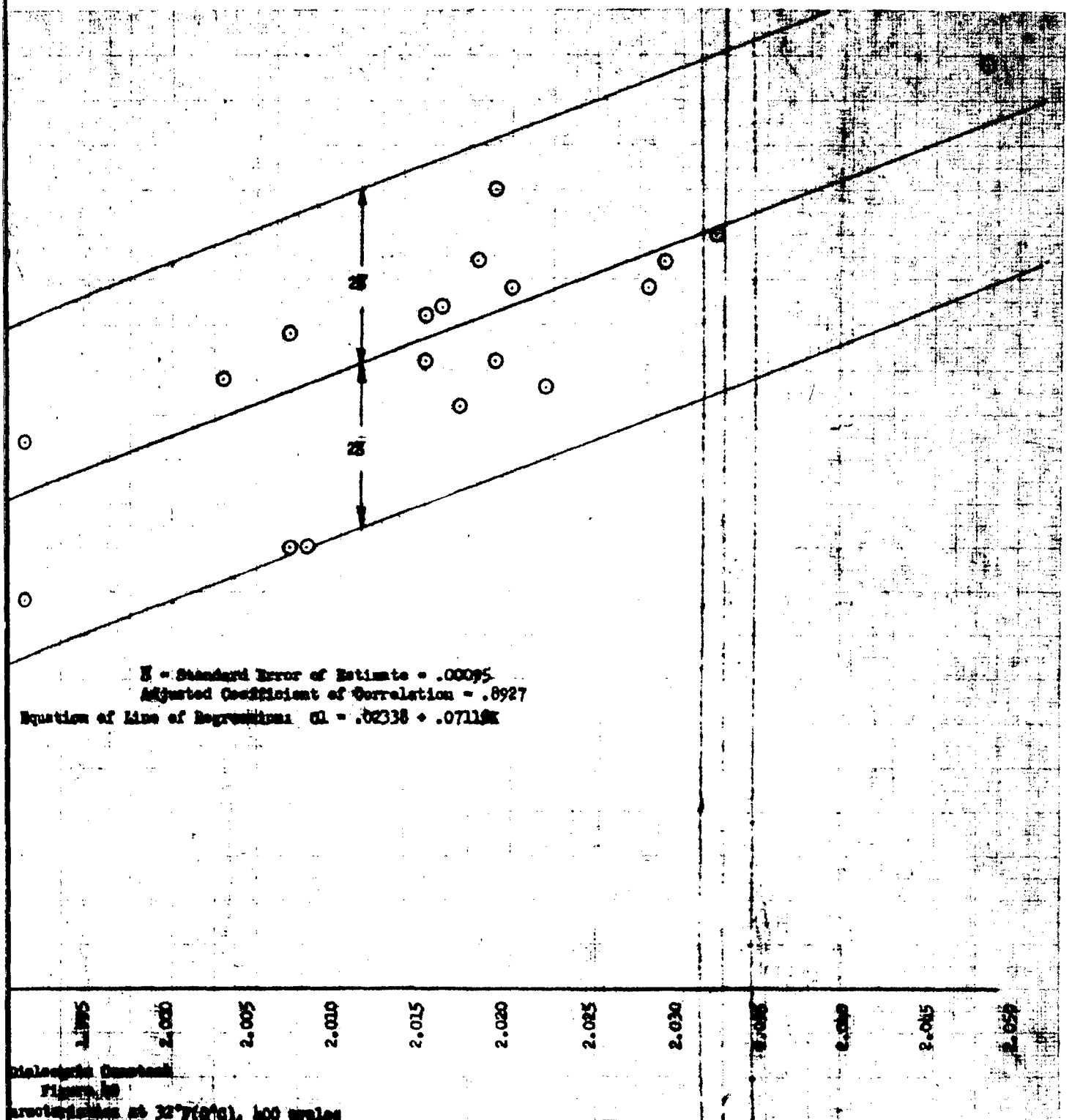
(2)



Equation of Line

Figure 10

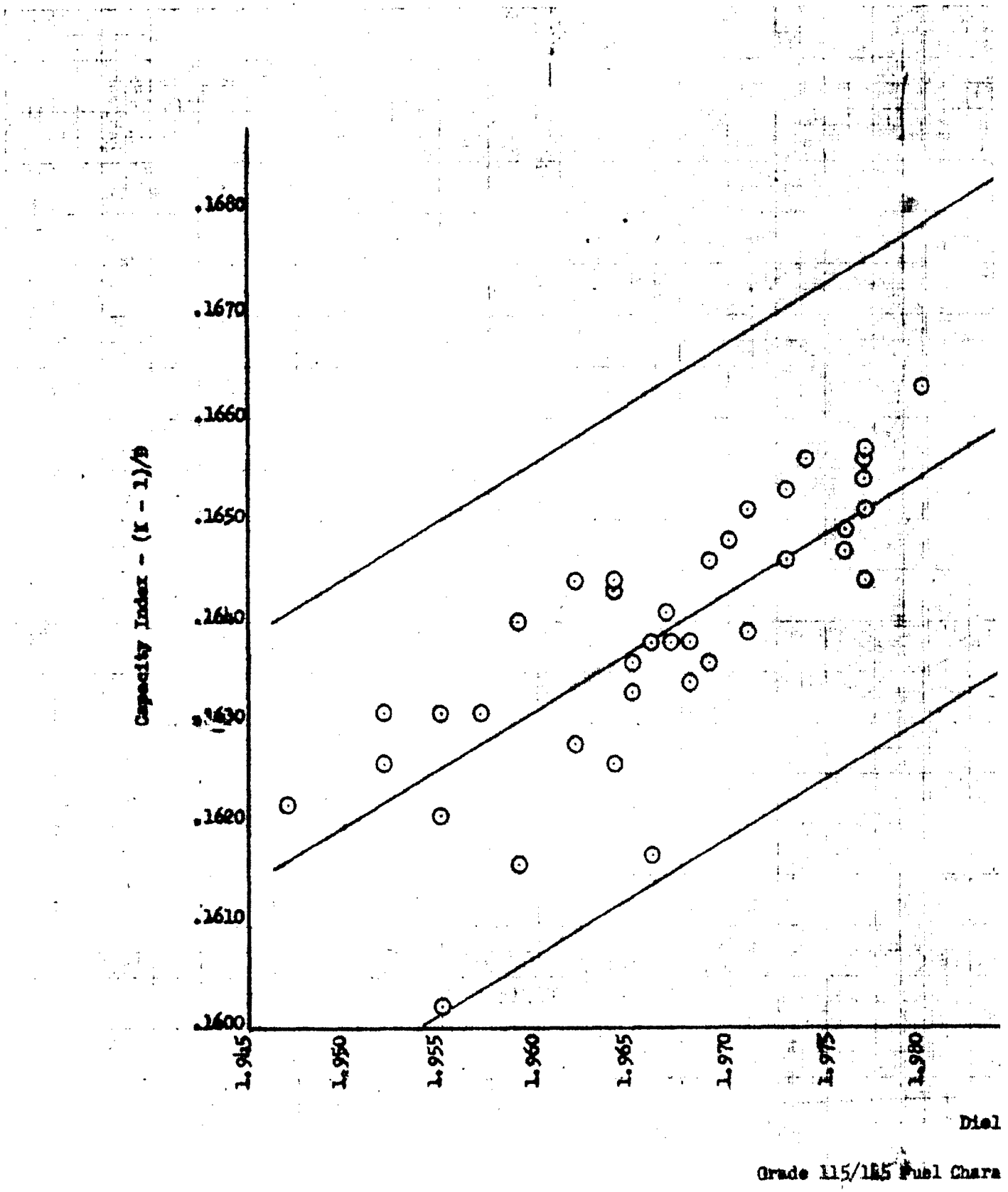
Crude 100/130 Peak Characteristics at 3

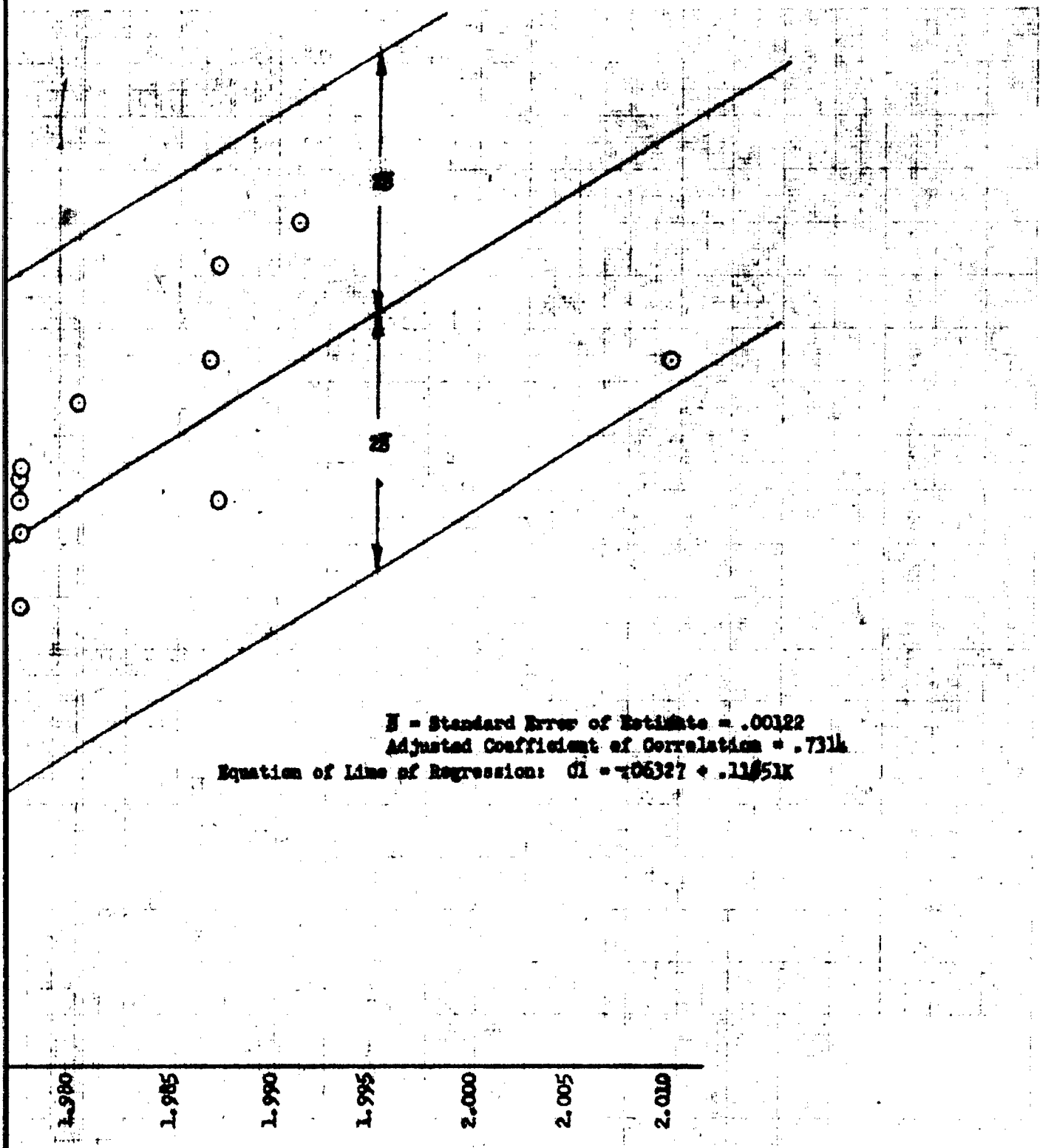


S = Standard Error of Estimate = .00095
Adjusted Coefficient of Correlation = .8927
Equation of Line of Regression: G1 = .02338 + .07118K

Dielectric Constant
Figure 10
Correlation at 32°F(0°C), 400 cycles

(2)


Capacity Index - (K - 1)/B
.1680
.1670
.1660
.1650
.1640
.1630
.1620
.1610
.1600
1.945
1.950
1.955
1.960
1.965
1.970
1.975
1.980
Diel
Grade 115/145 Fuel Chara



S = Standard Error of Estimate = .00122
Adjusted Coefficient of Correlation = .731k
Equation of Line of Regression: Cl = -.06327 + .11851K

Dielectric Constant

Figure 41

115 Fuel Characteristics at 32°F(0°C), 400 cycles

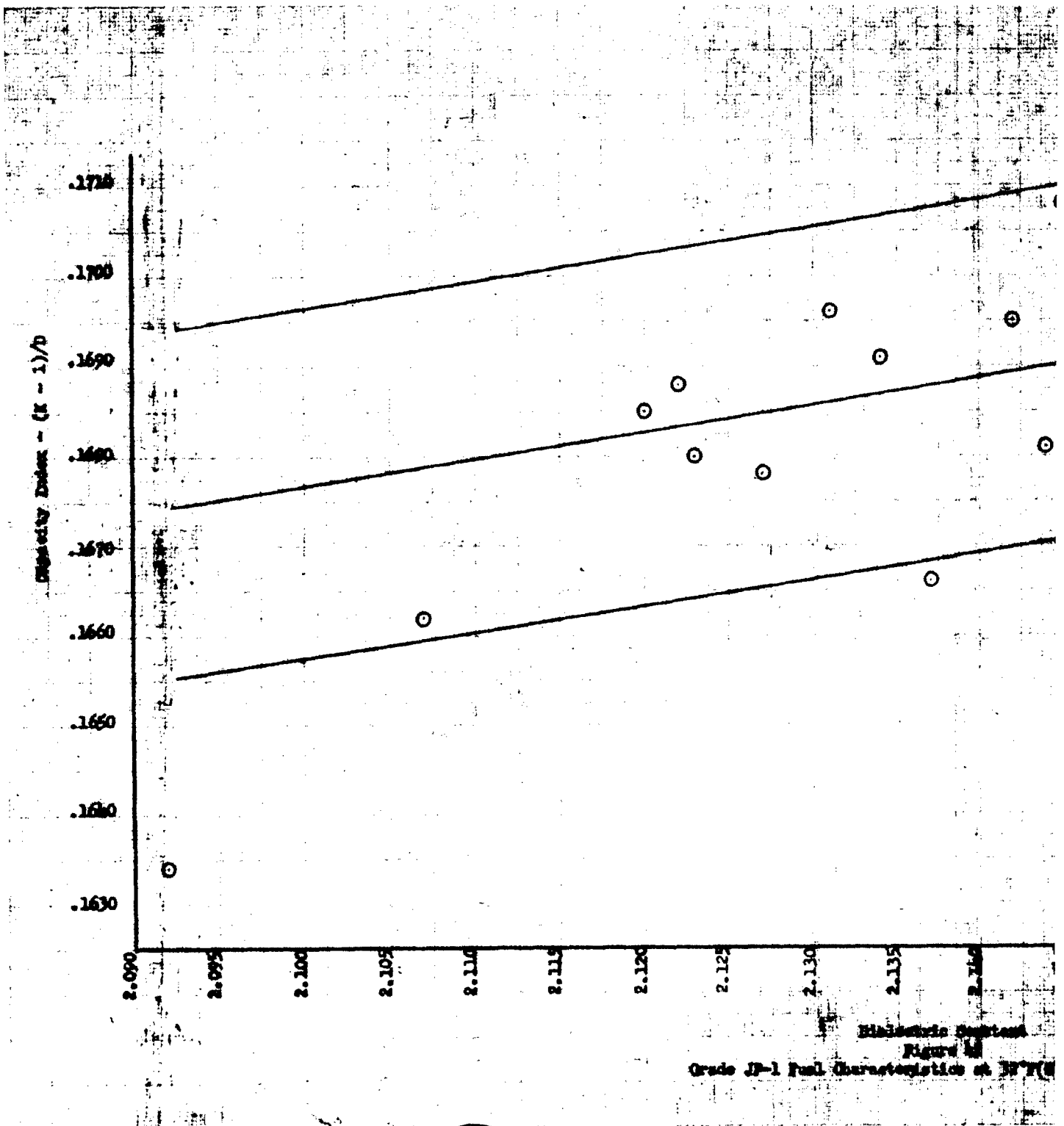
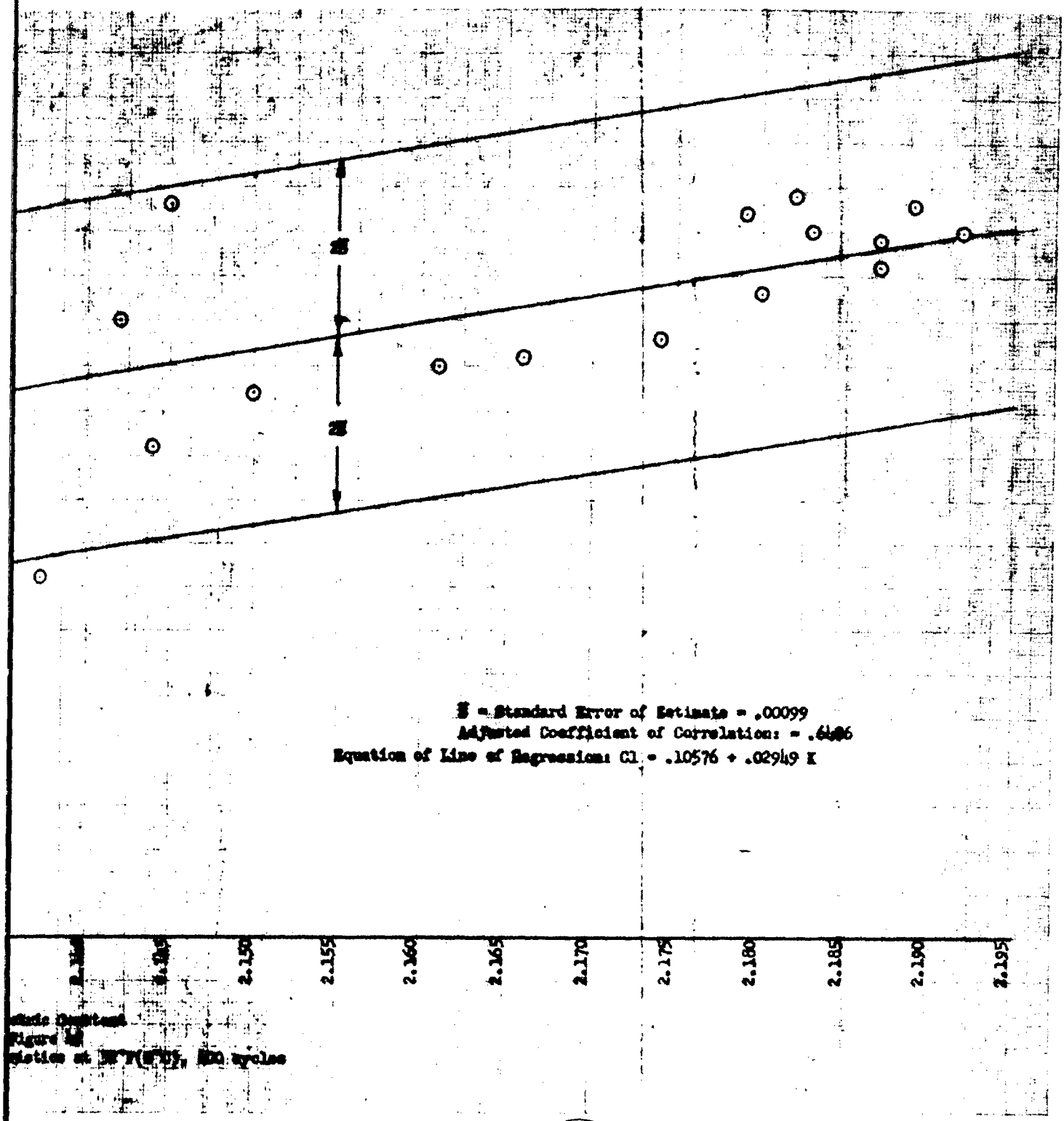


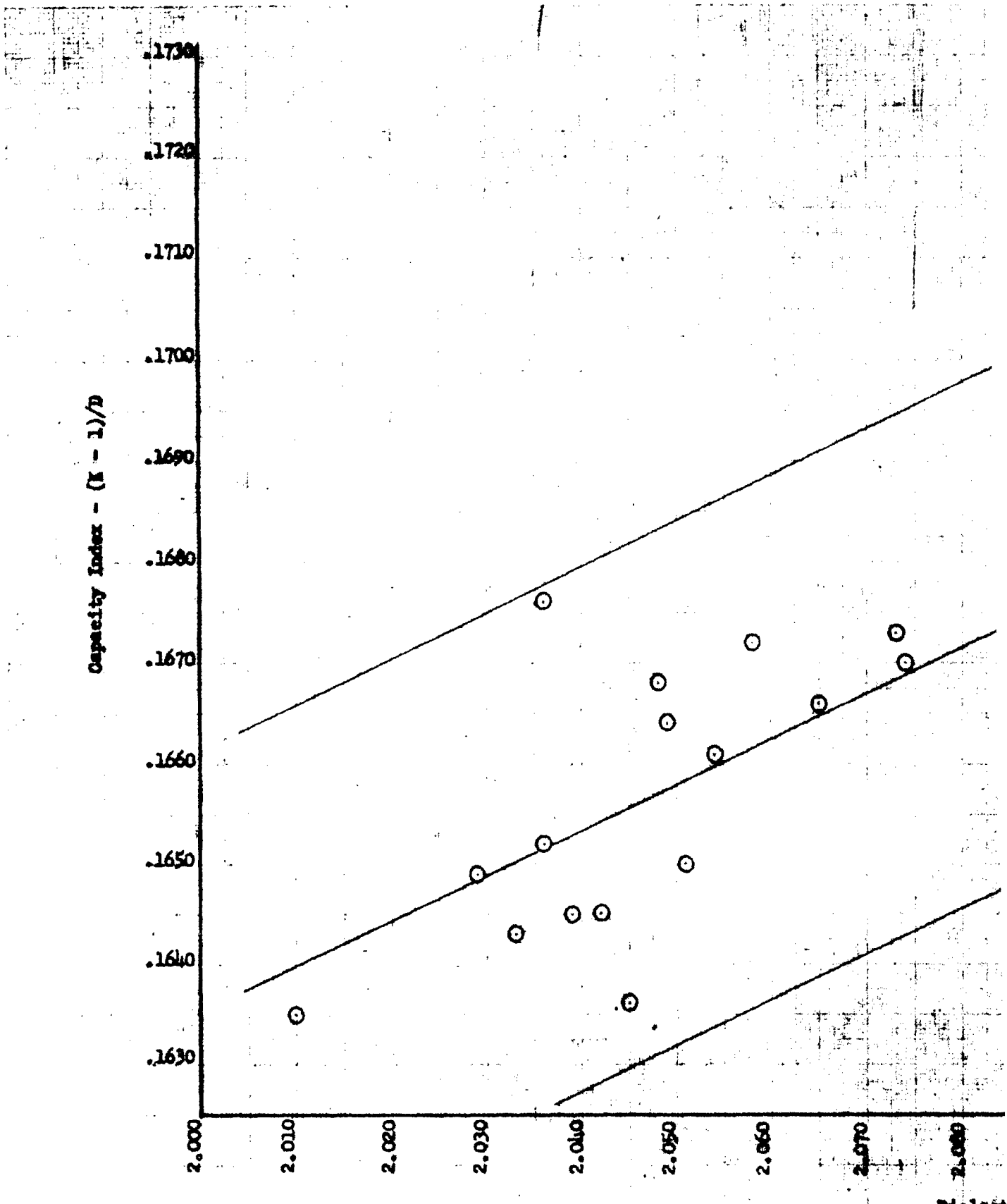
Figure 52
Grade JP-1 Fuel Characteristics at 32°F(0



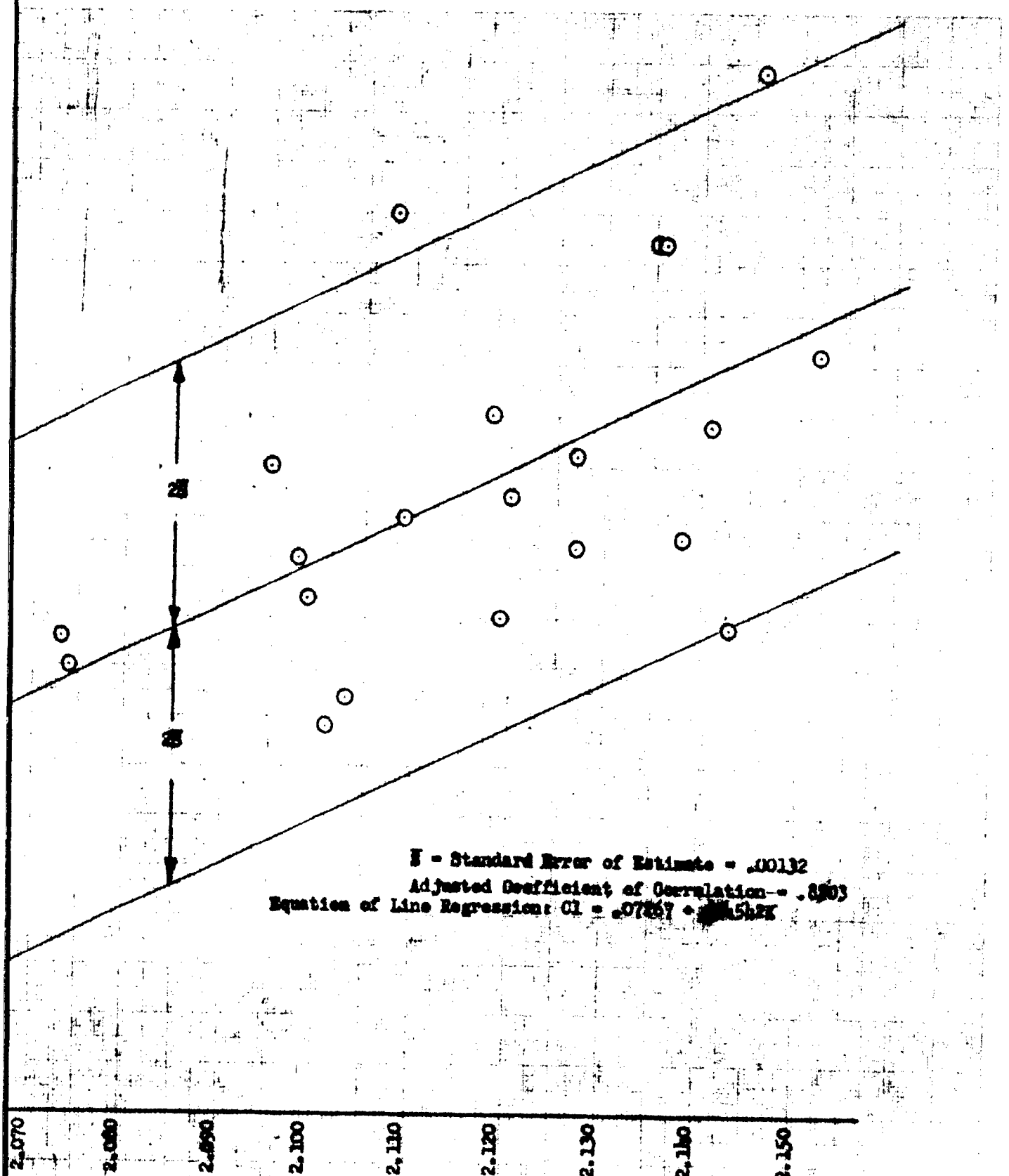
S = Standard Error of Estimate = .00099
Adjusted Coefficient of Correlation: = .6486
Equation of Line of Regression: Cl = .10576 + .02949 K

[illegible] Content
Figure [illegible]
[illegible] at [illegible], 500 cycles

(2)



Dielect
Fig
Grade JP-3 Fuel Characteri

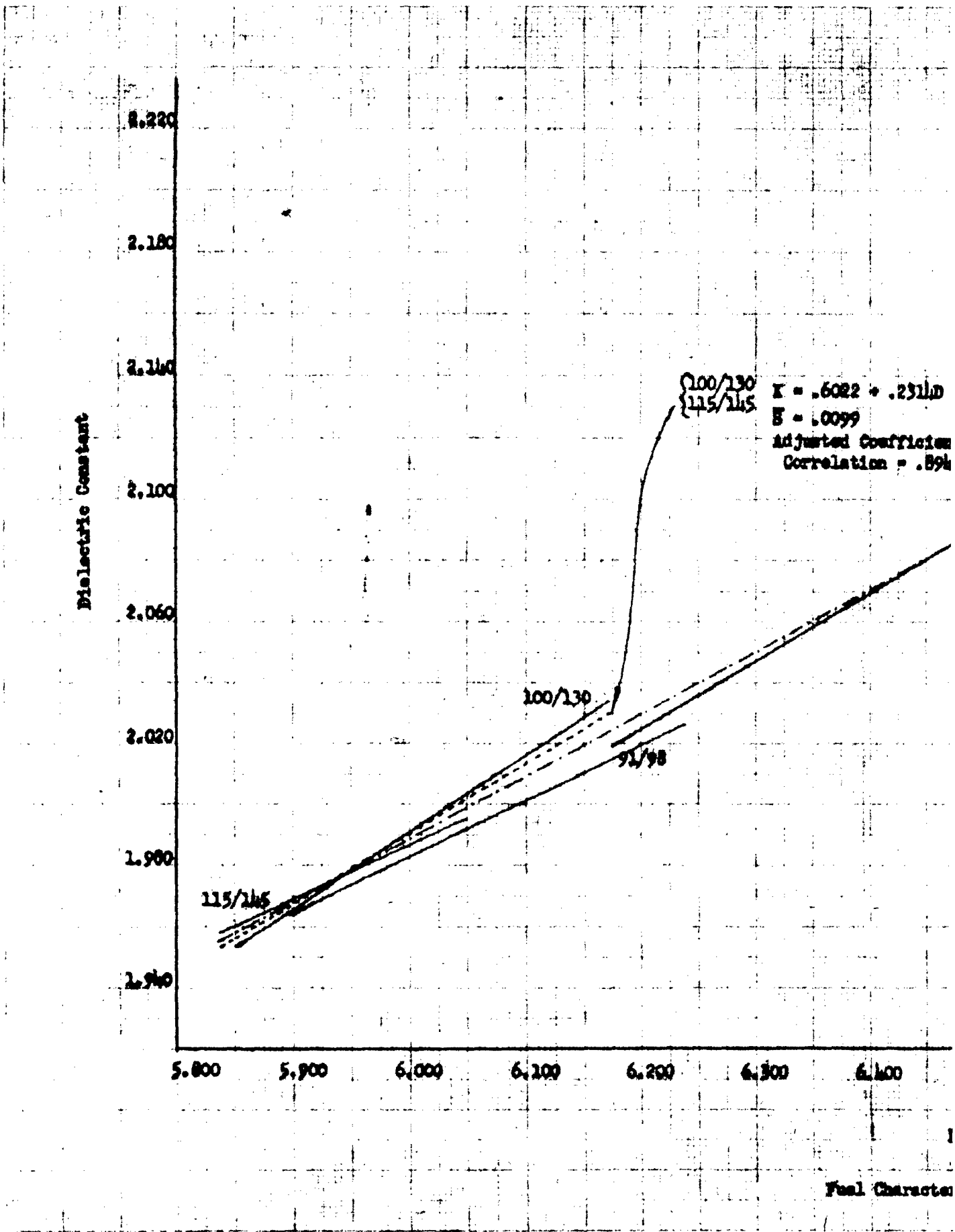


Dielectric Constant

Figure 43

Fuel Characteristics at 32°F(0°C), 400 cycles

(2)


Dielectric Constant
2.220
2.180
2.140
2.100
2.060
2.020
1.980
1.940
5.800
5.900
6.000
6.100
6.200
6.300
6.400
100/130
115/145
100/130
115/145
K = .6022 + .231LD
E = .0099
Adjusted Coefficien
Correlation = .89
100/130
91/98
115/145
Final Characte

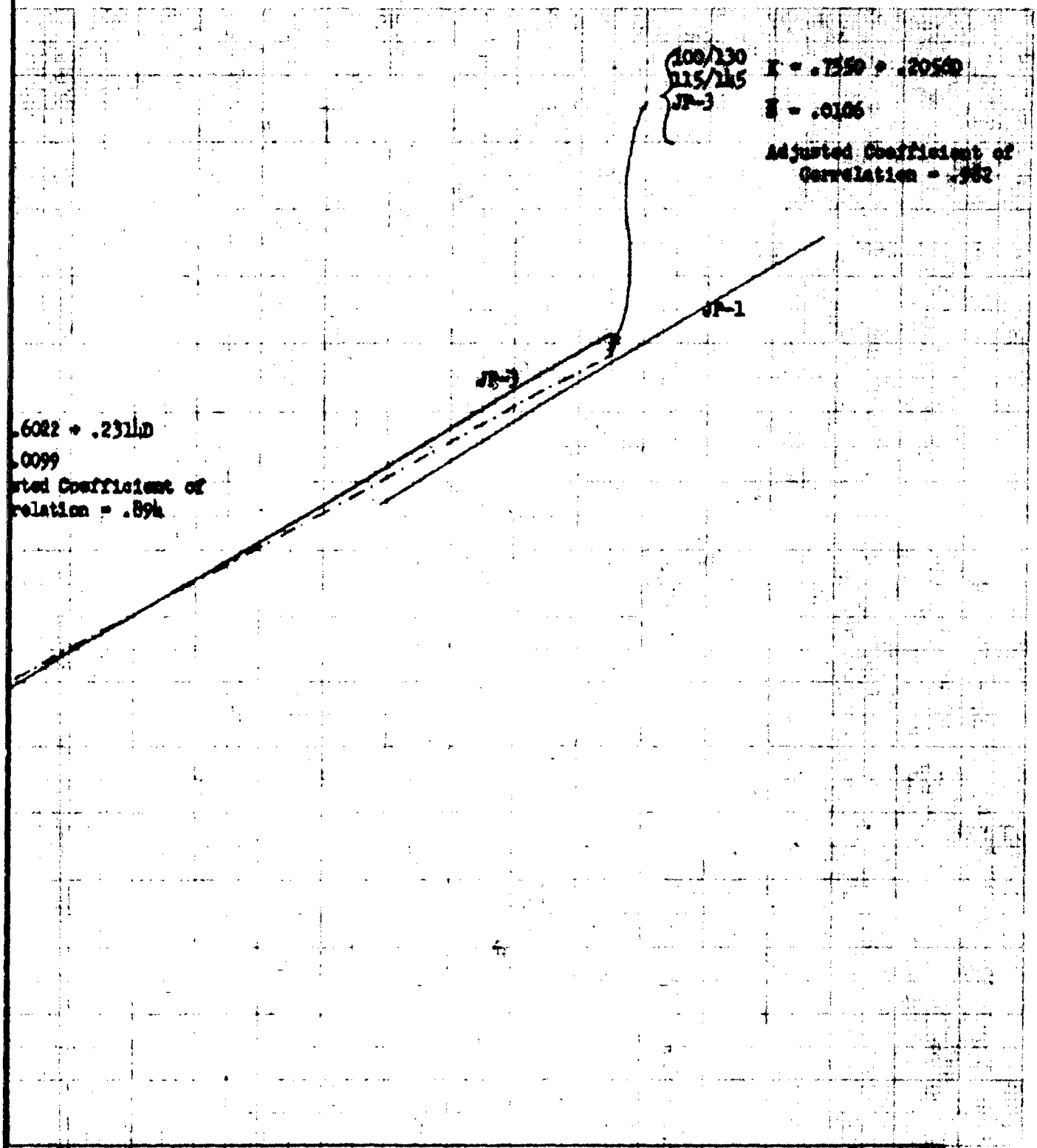


Figure 44

Fuel Characteristics at 32°F(0°C), 400 cycles

(2)

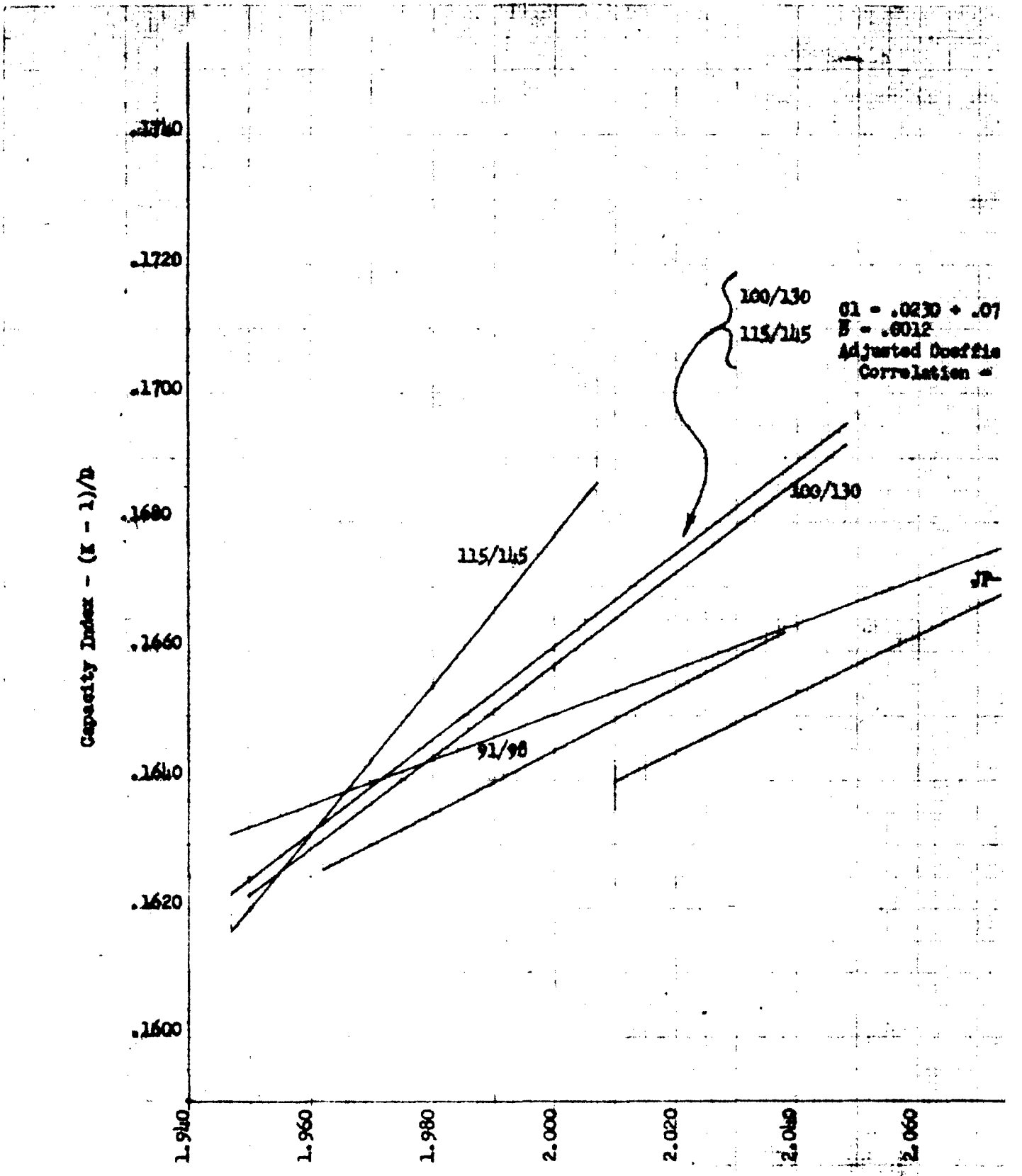
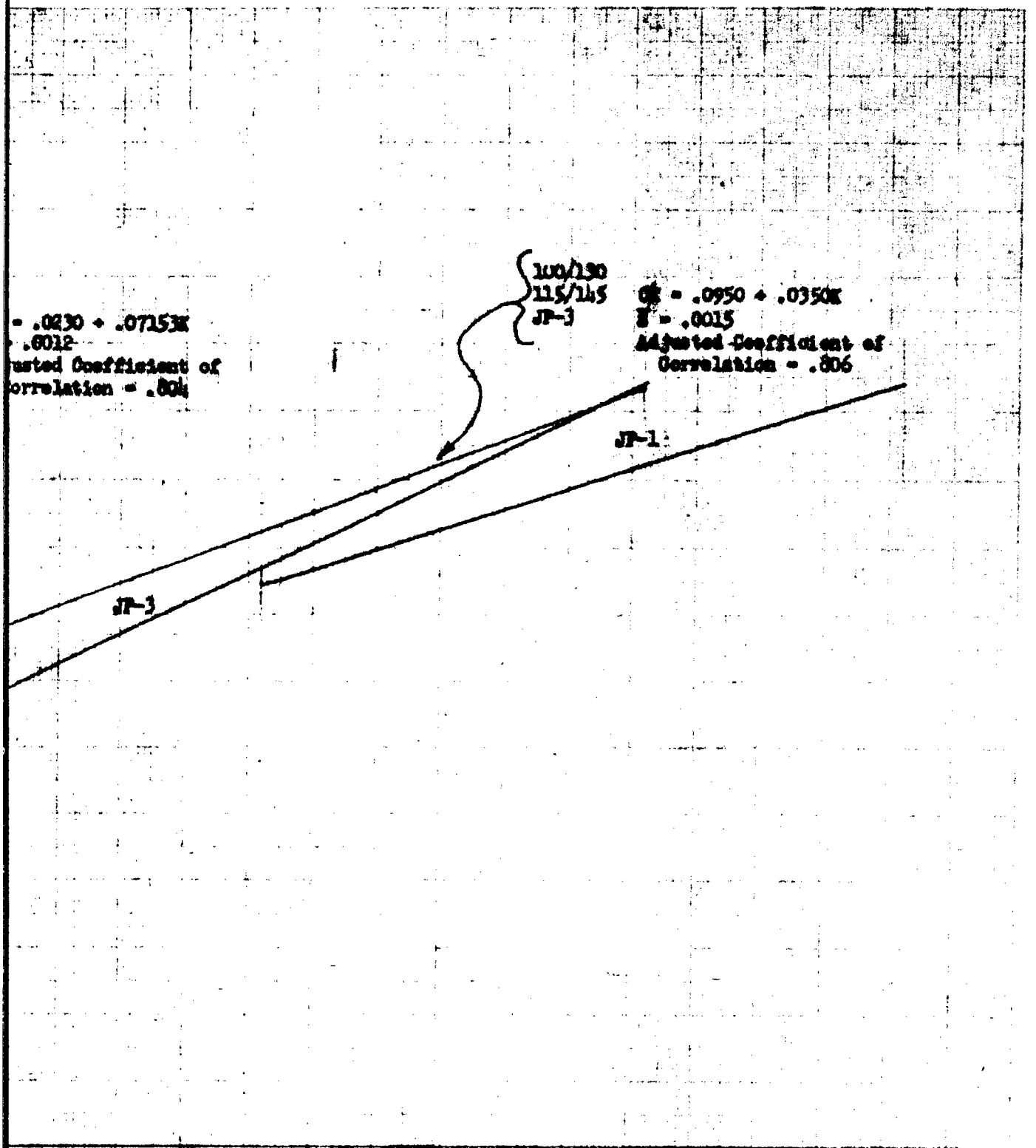


Figure 45

Fuel Characteristics at 32°F(



2.060 2.080 2.100 2.120 2.140 2.160 2.180 2.200

lectric Constant

Figure 45

tics at 32°F(0°C), 400 cycles

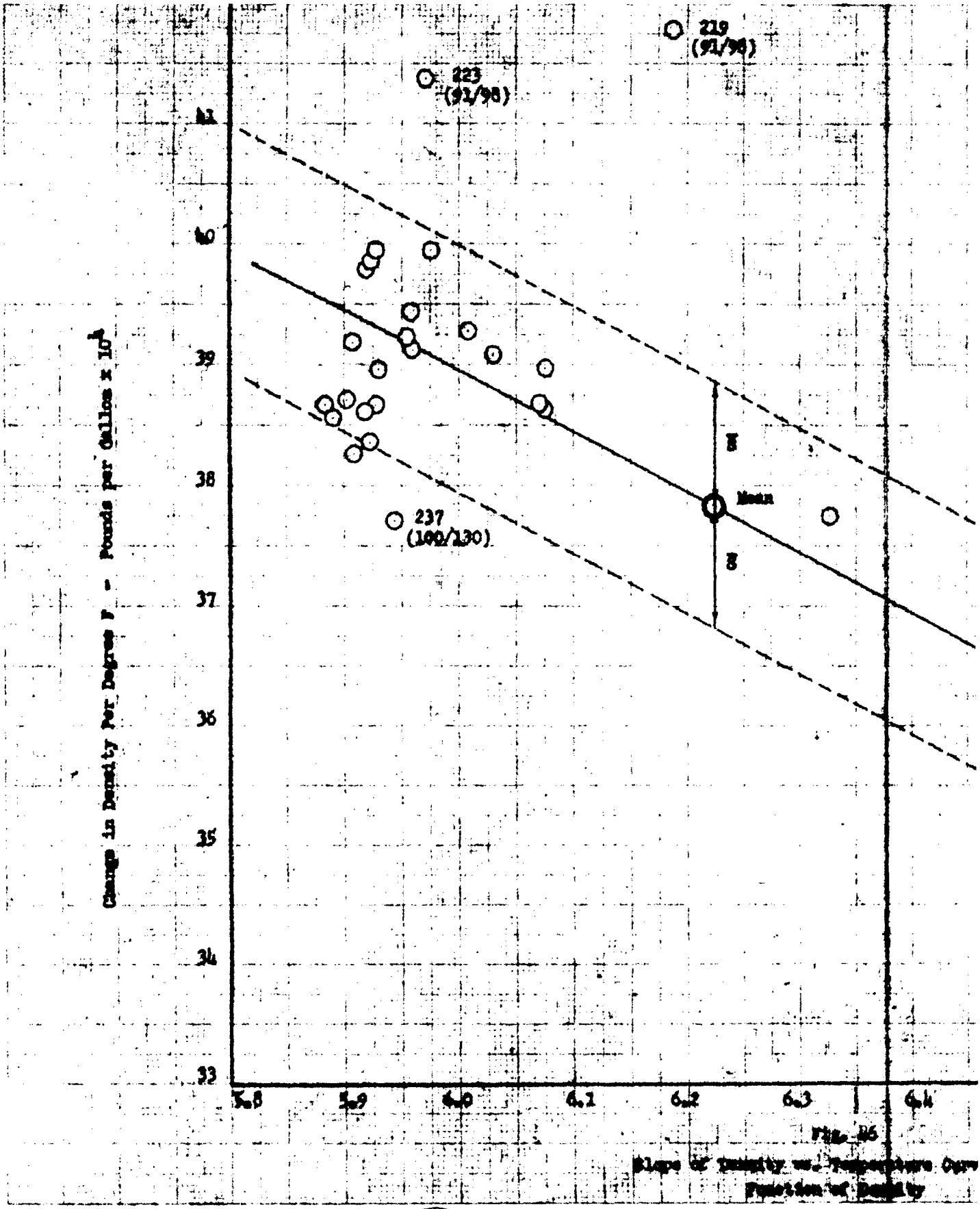
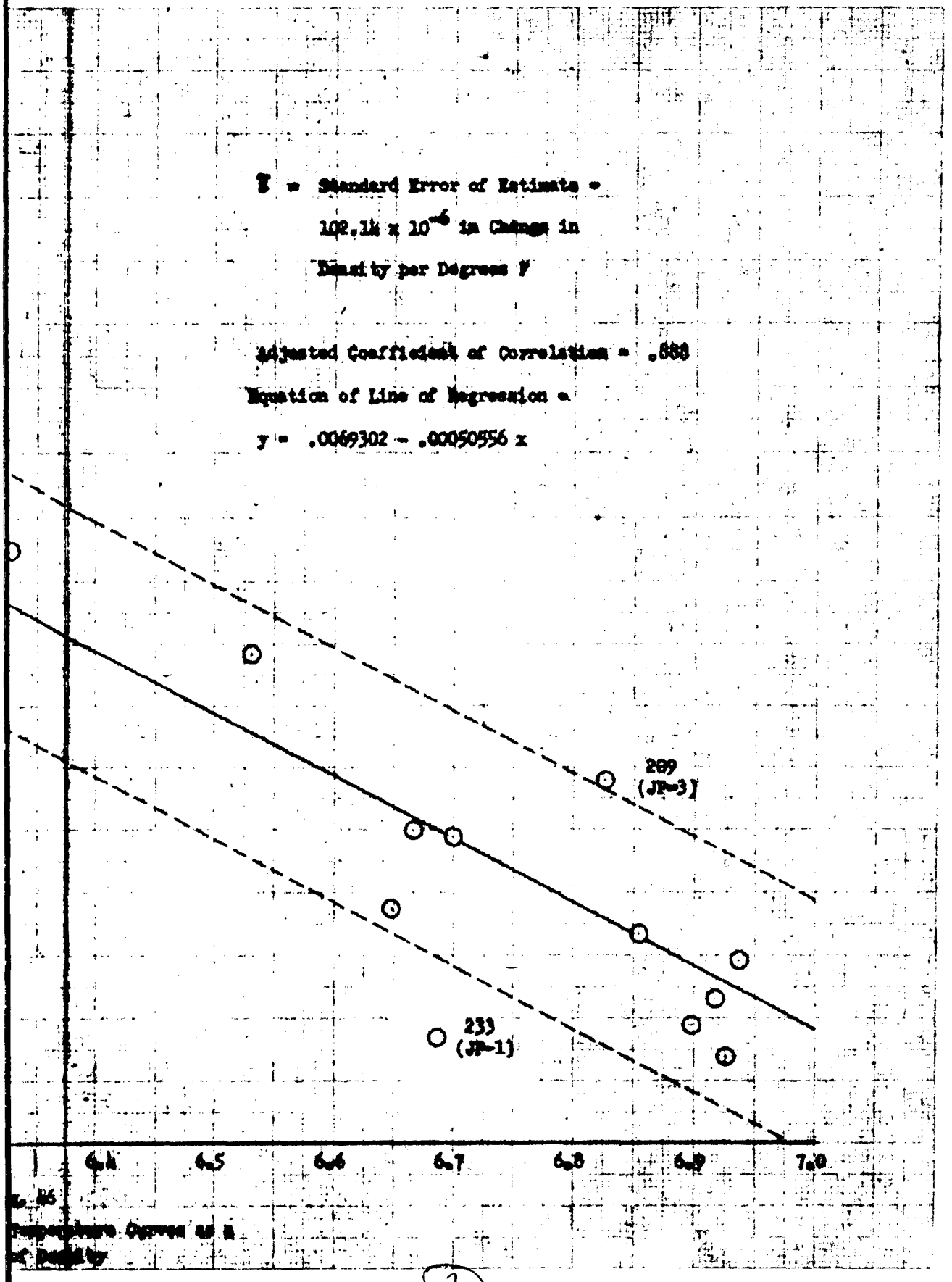


Fig. 86

Slope of Density vs. Temperature Curve
Function of Density

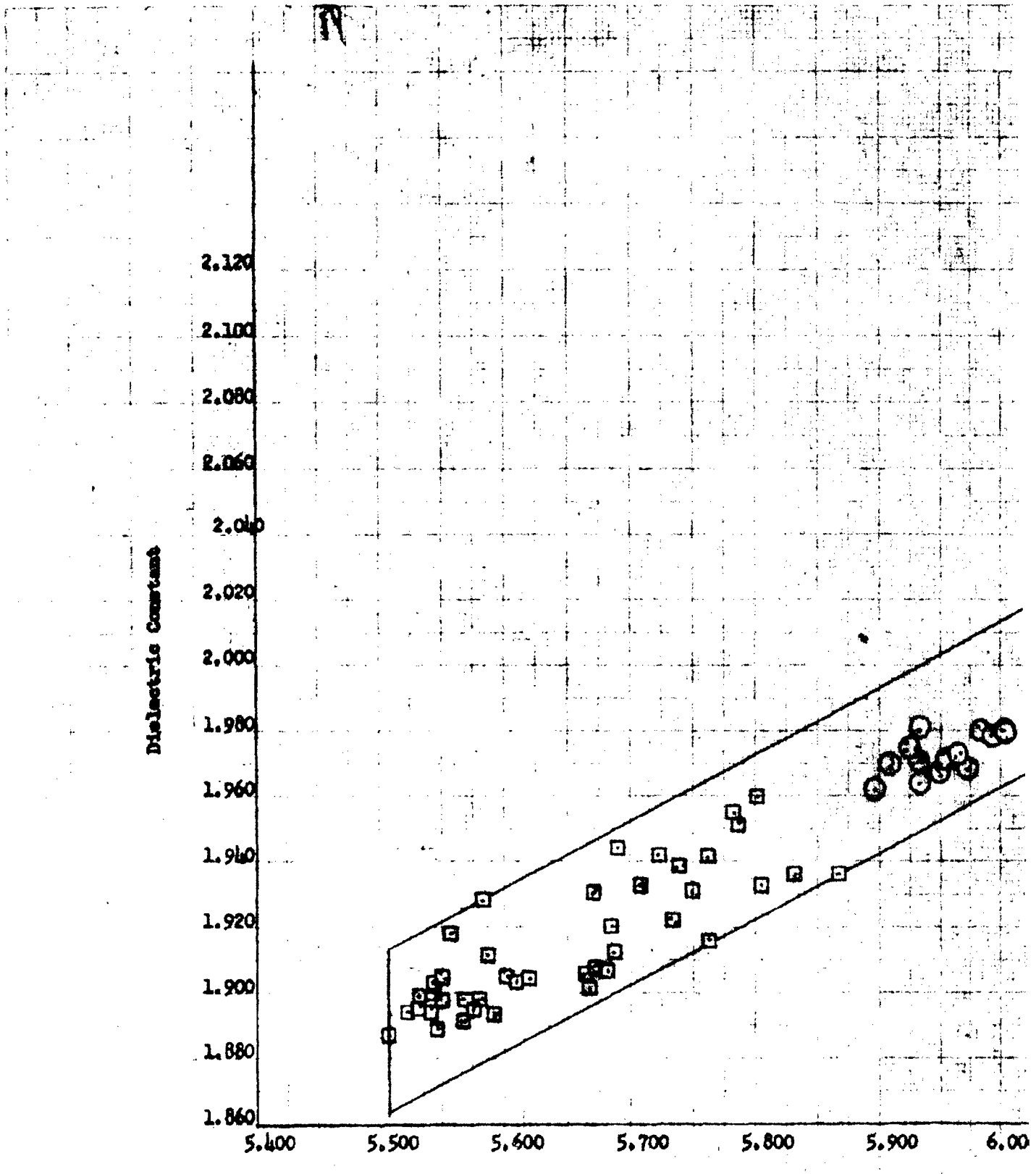
Density at 32 Degrees F - Pounds per



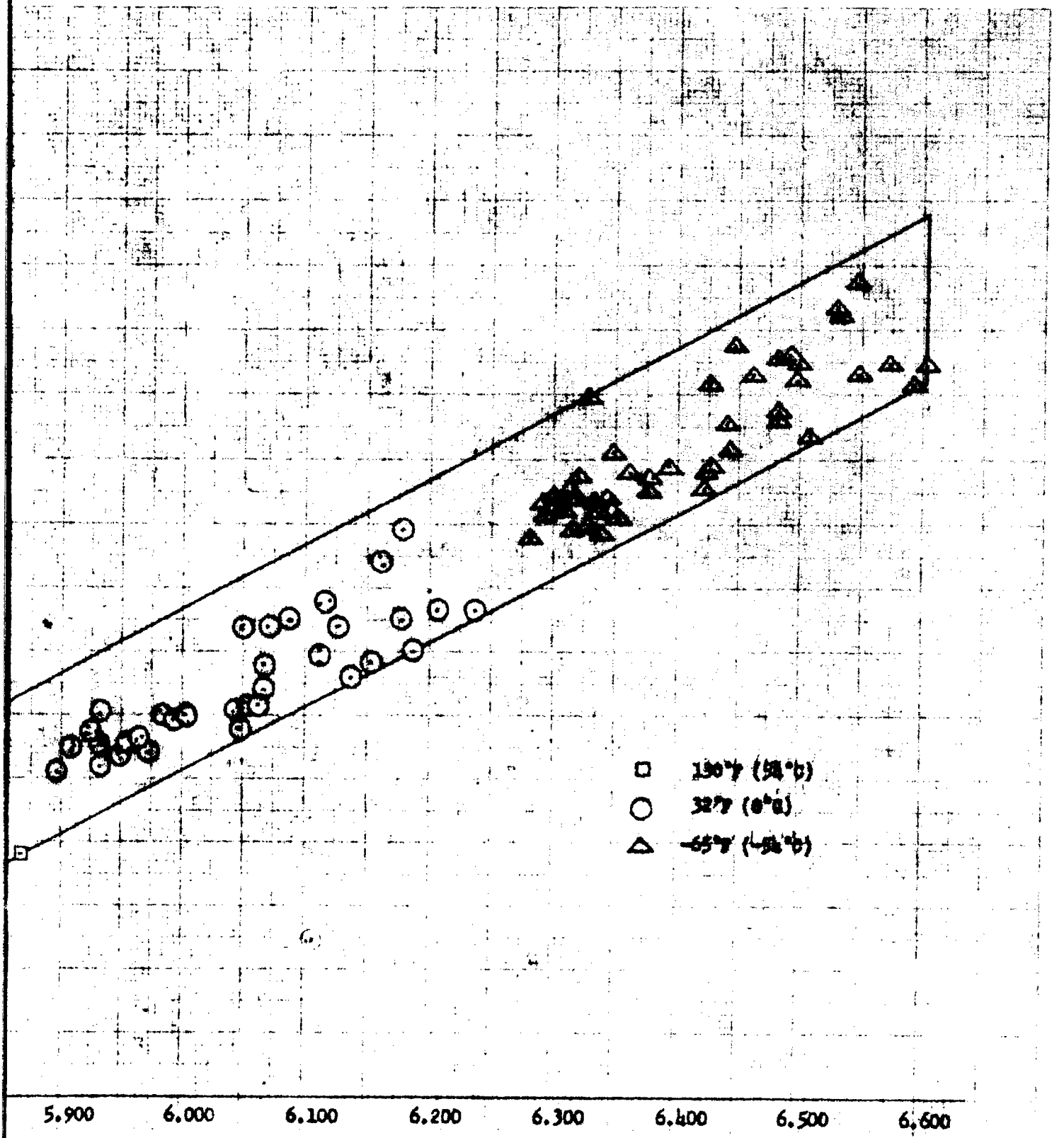
Temperature Curves as a
of Density

(2)

S - Pounds per Gallon



Grade 91/98 Fuel Characteristics at -65°F

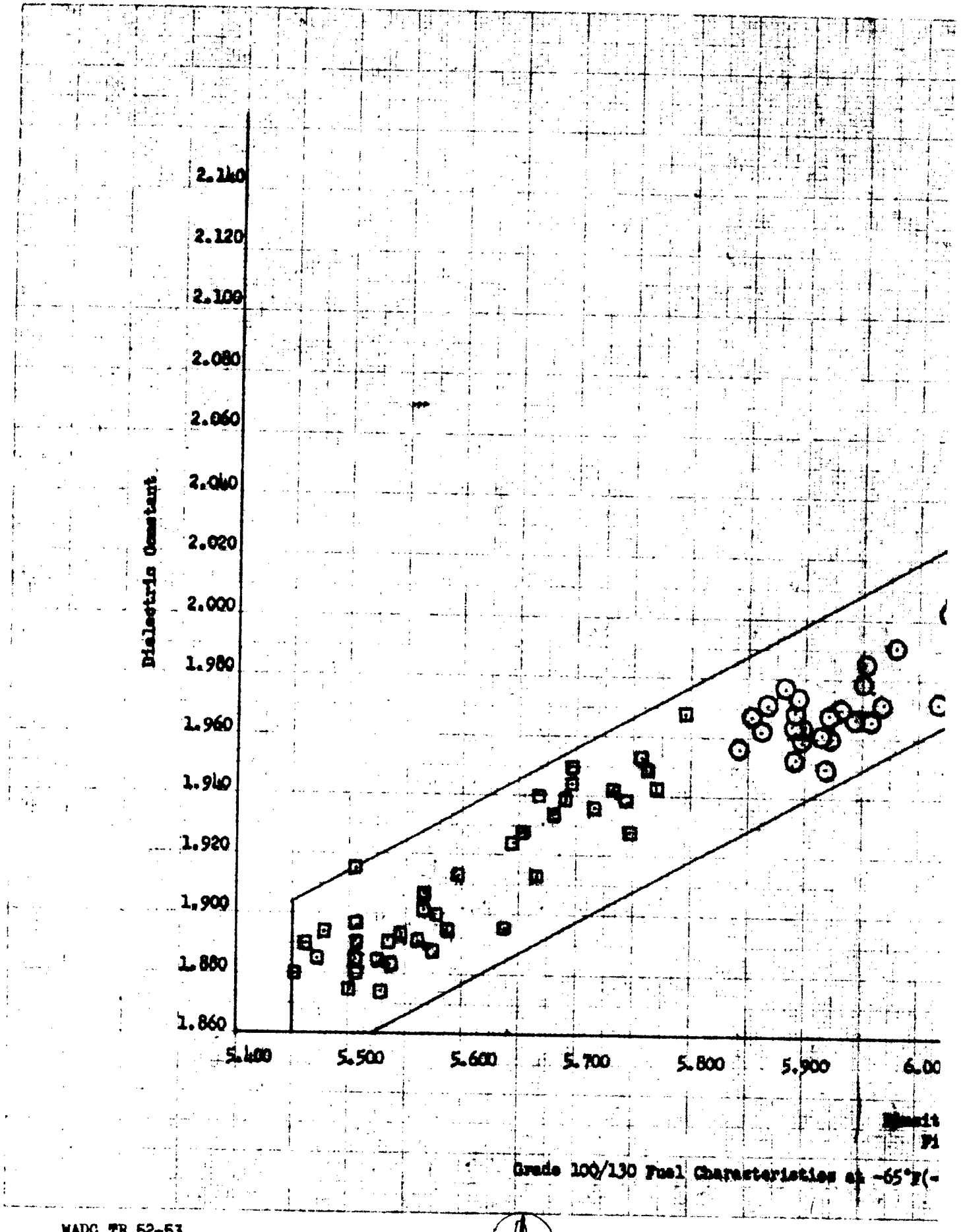


Density - Pounds Per Gallon

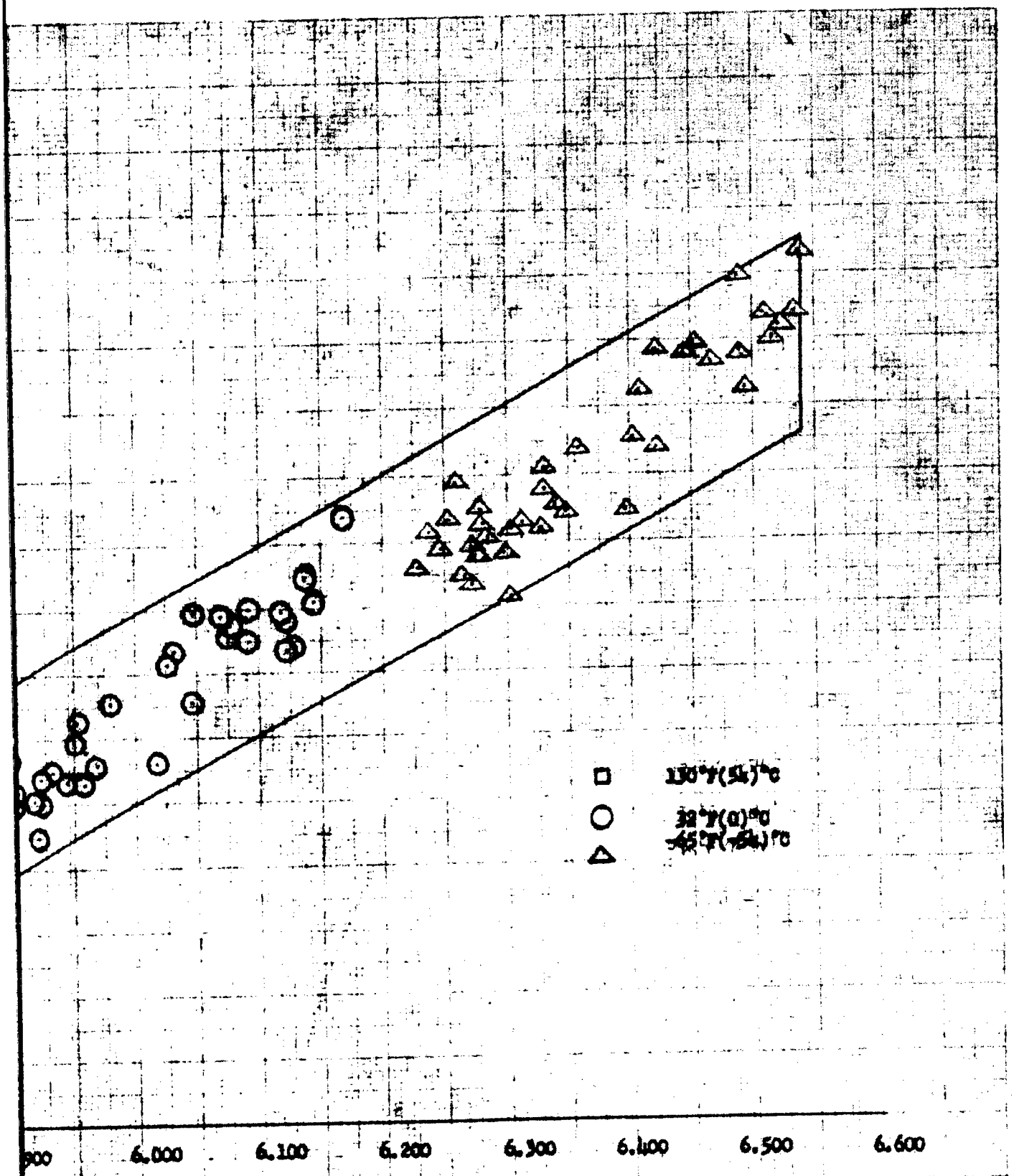
Figure 47

...teristics at -65°F(-54°C), 32°F(0°C), and 130°F(54°C), 400 cycles

(2)



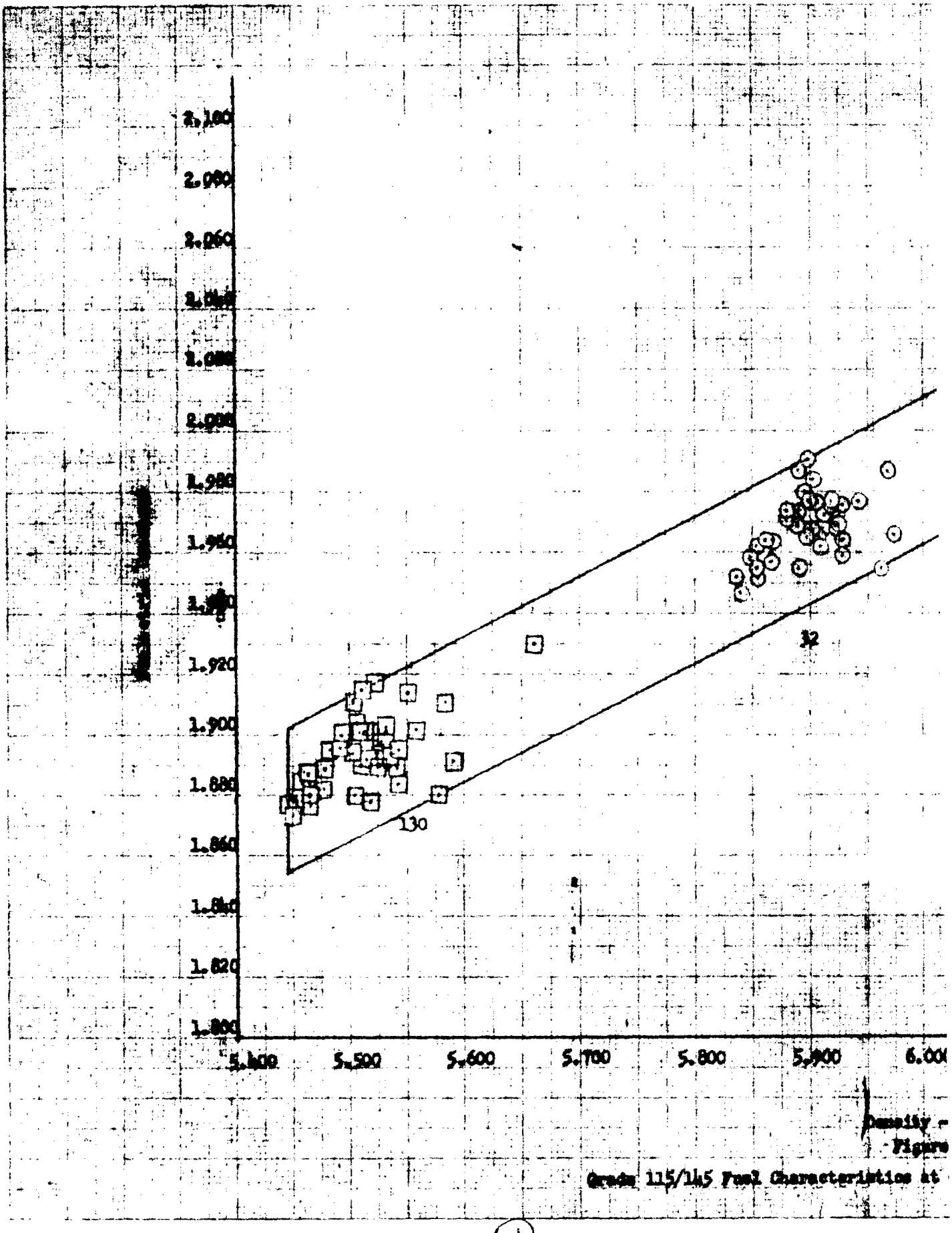
Grade 100/130 Fuel Characteristics at -65°F(-



Density - Lb/Gallon
Figure 48

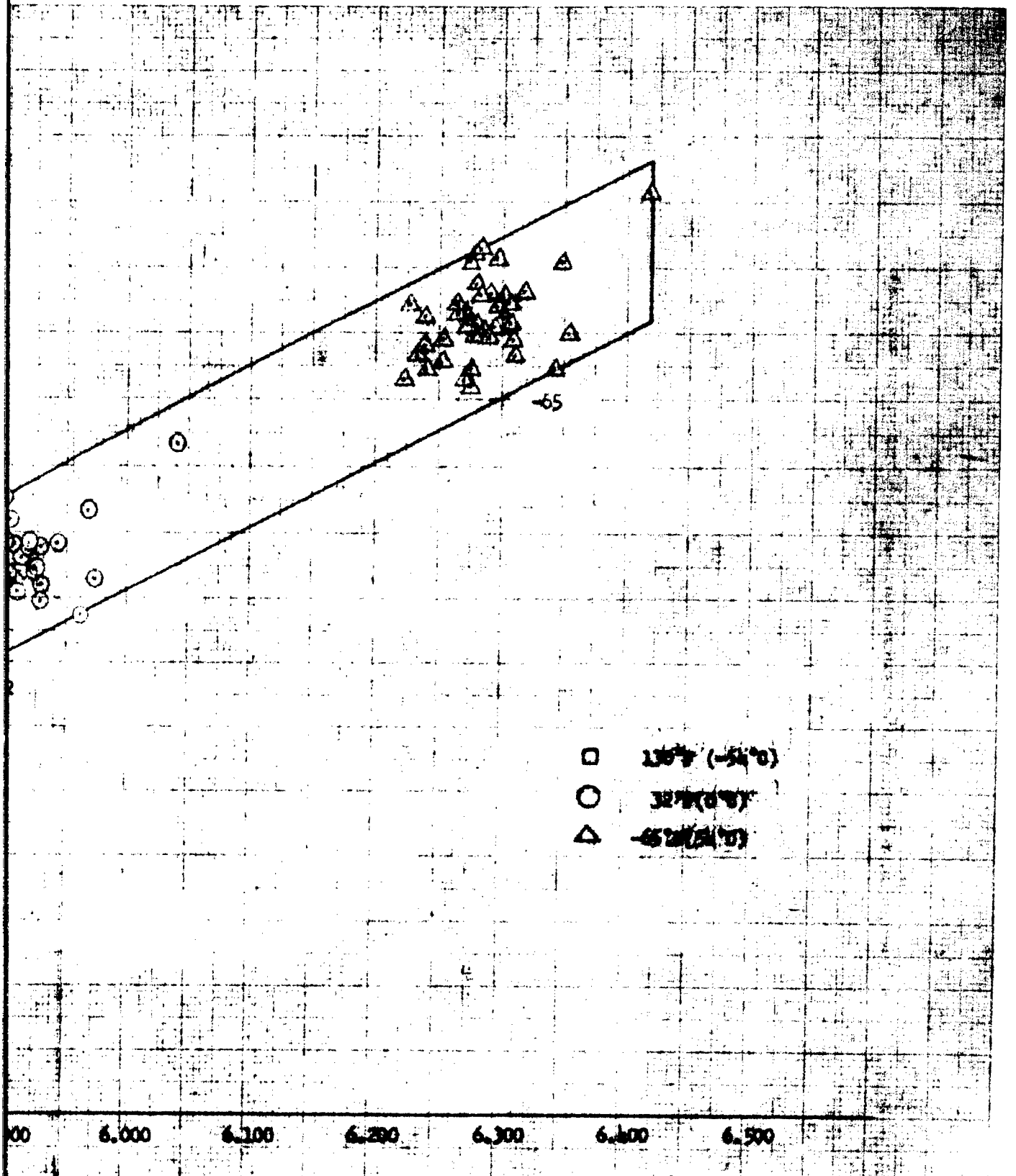
...ies at -65°F(-54°C), 32°F(0°C), and 130°F(54°C), 400 cycles

(2)



Density -
Figure

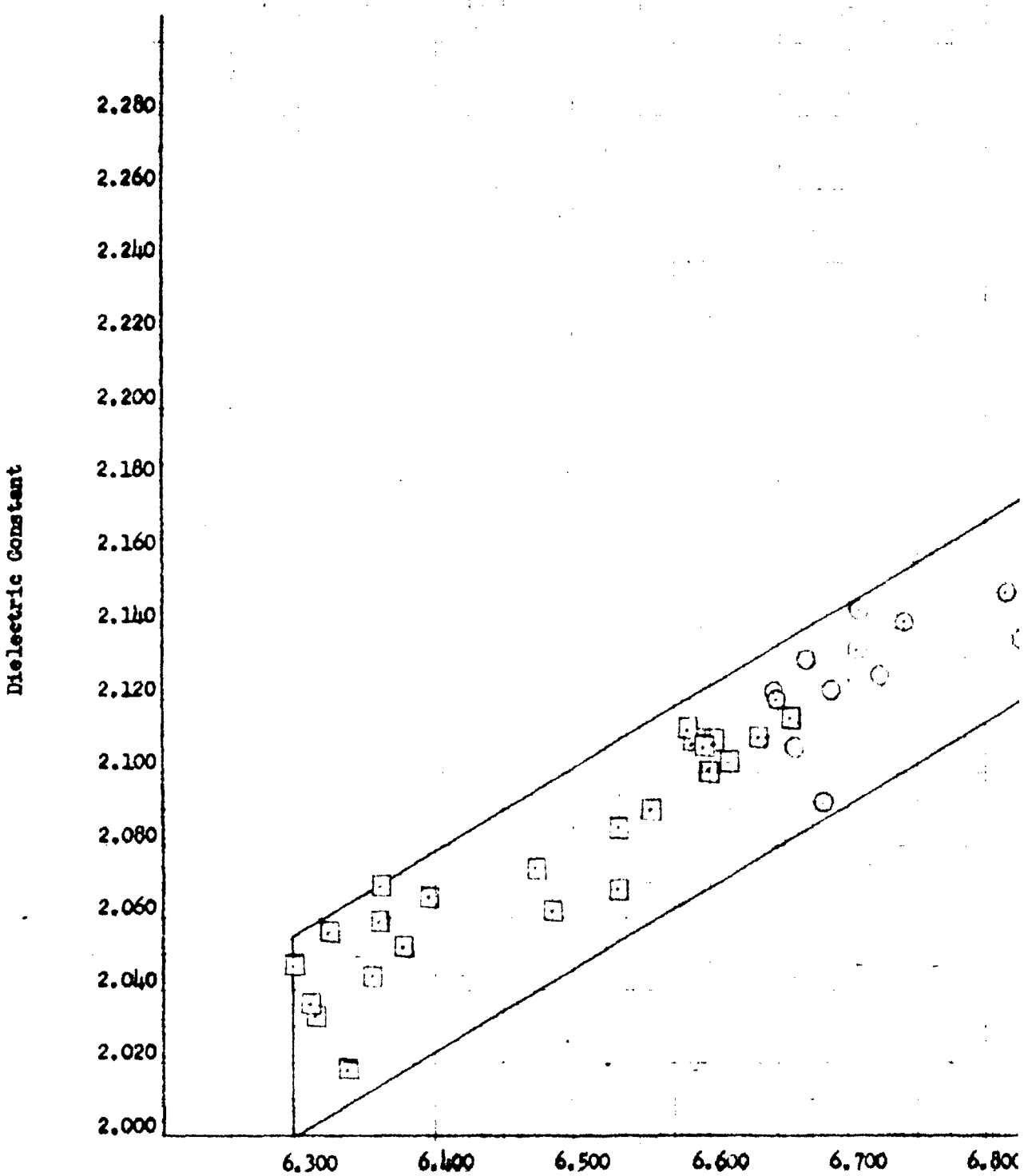
Grade 115/145 Final Characteristics at



Density - lb/Gallon

Figure 49

...teristics at -65°F(-54°C), 32°F(0°C), and 130°F(54°C), 400 cycles



Density

Fig

Grade JP-1 Fuel Characteristics at -65°F(-54'

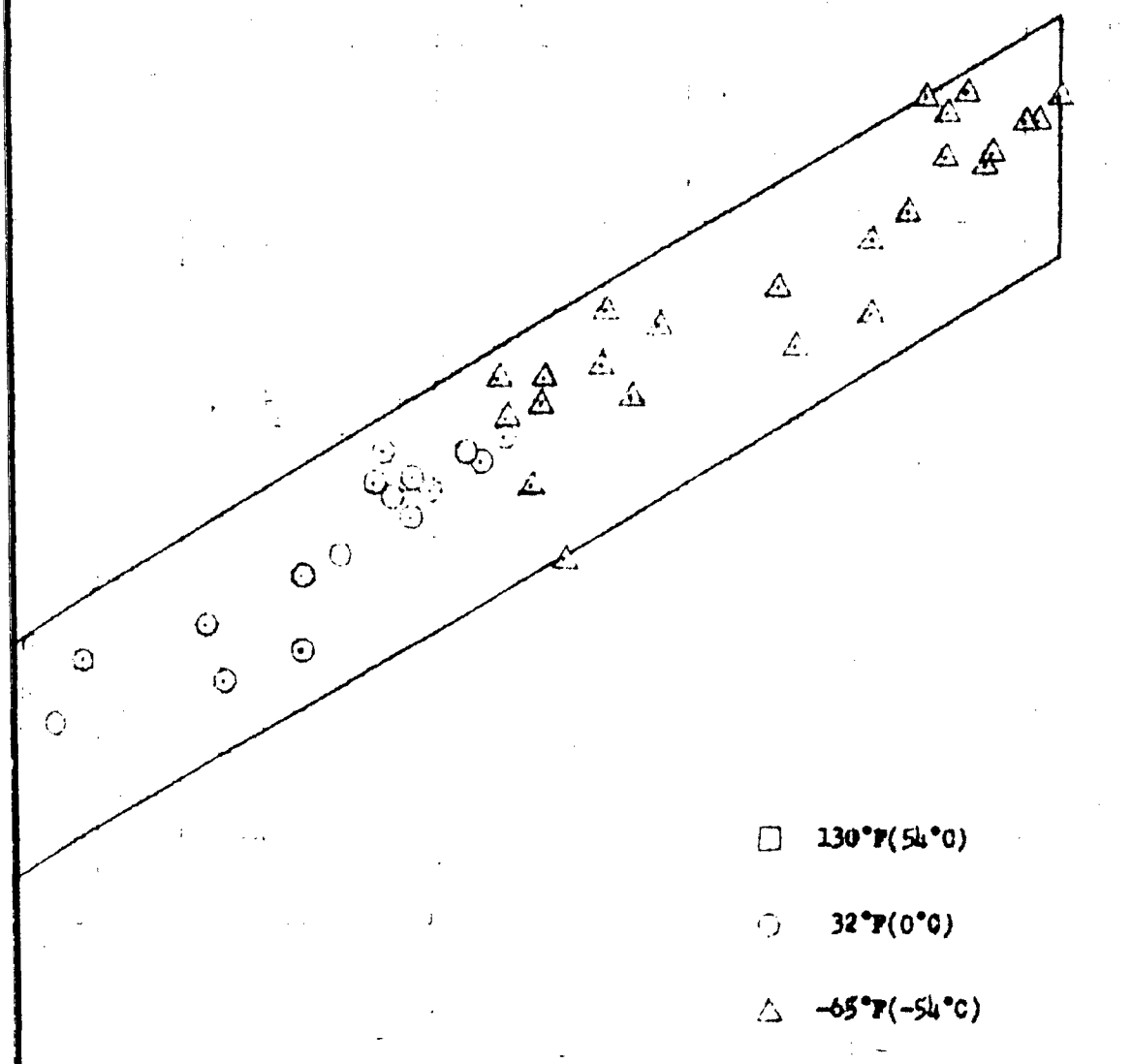
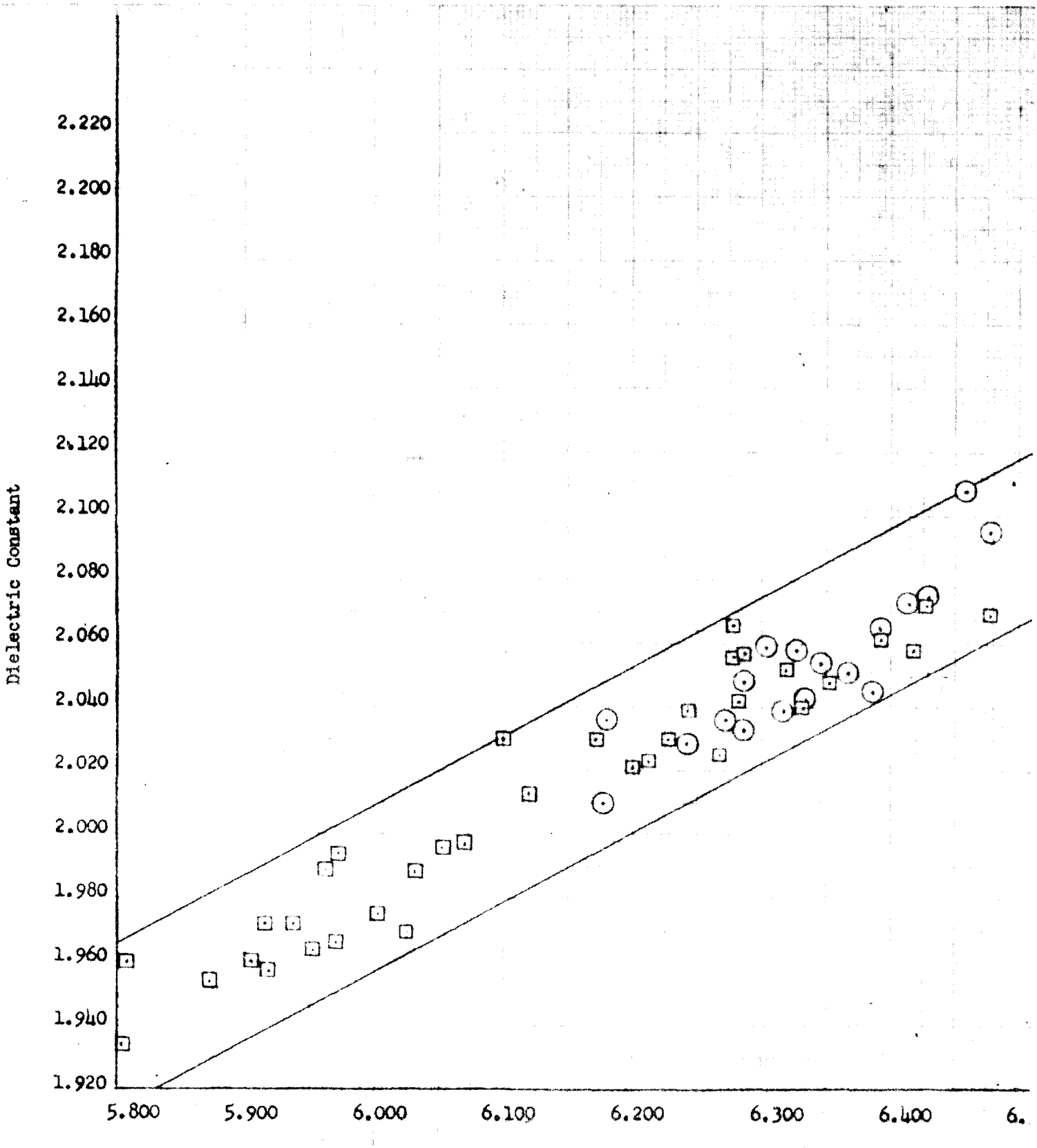


Figure 50

s at -65°F(-54°C), 32°C(0°C), and 130°F(54°C), 400 cycles

(2)



Density -

Figu

Grade JP-3 Fuel Characteristics at -65°F(-54°C),32°F(0

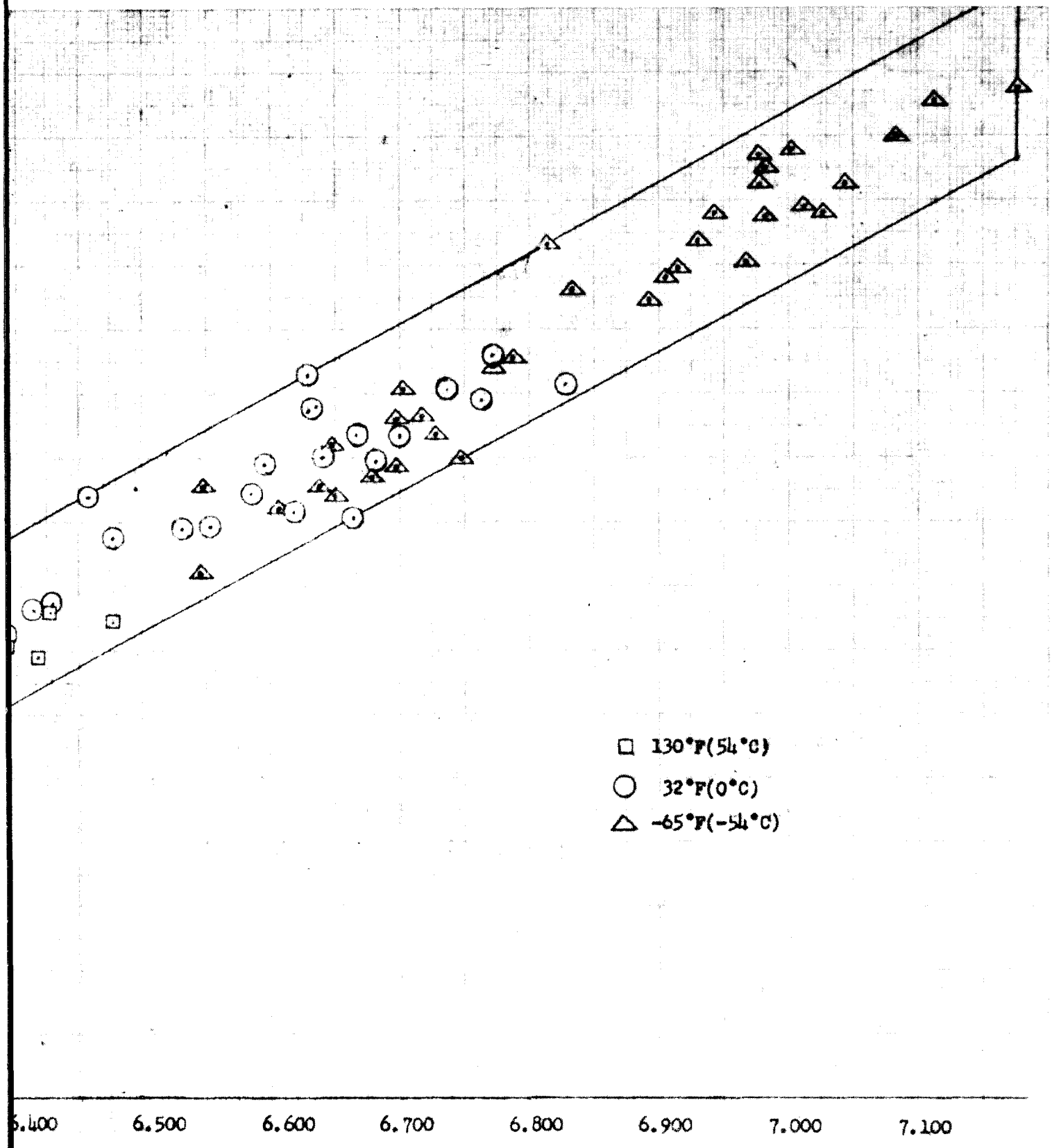
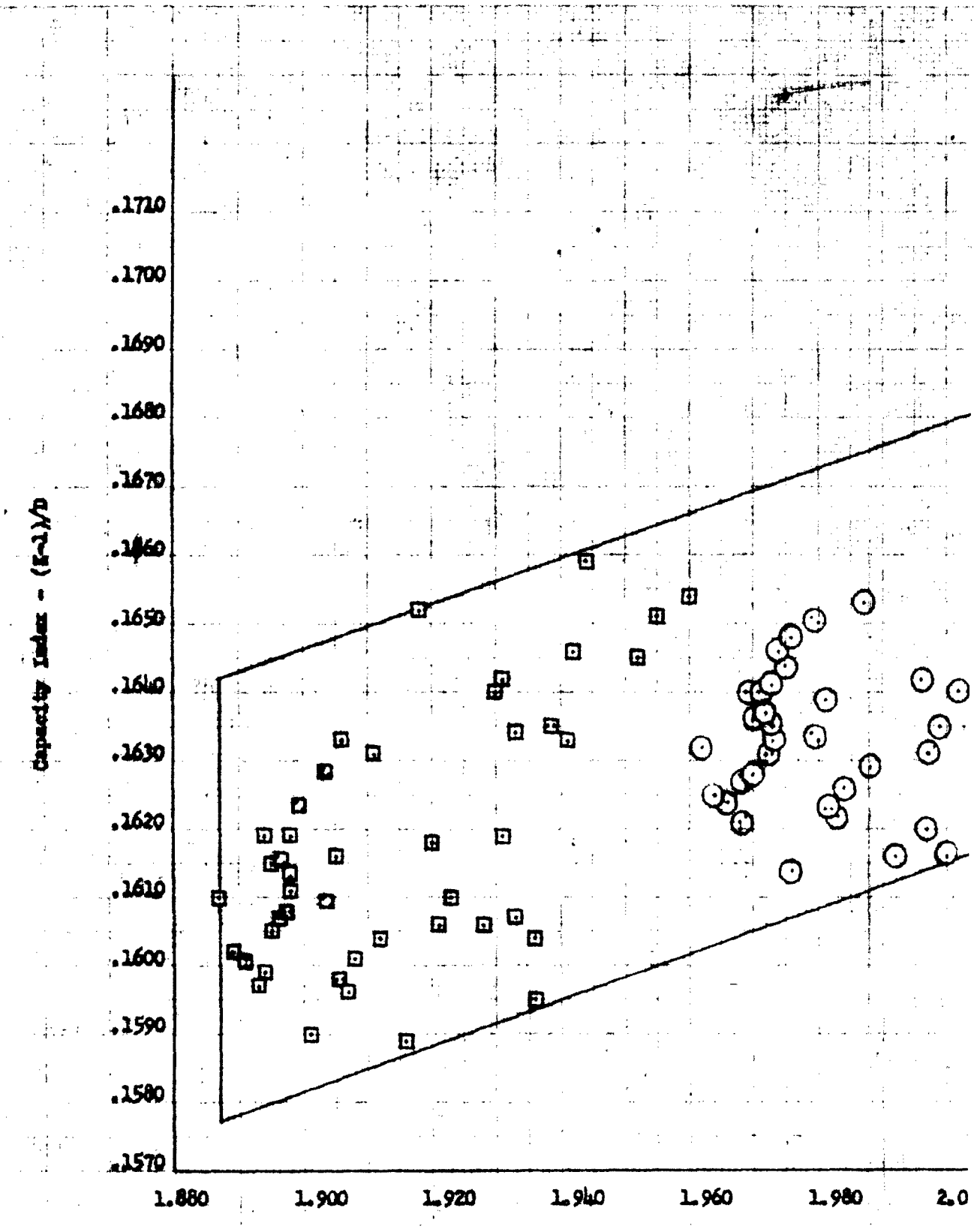


Figure 51

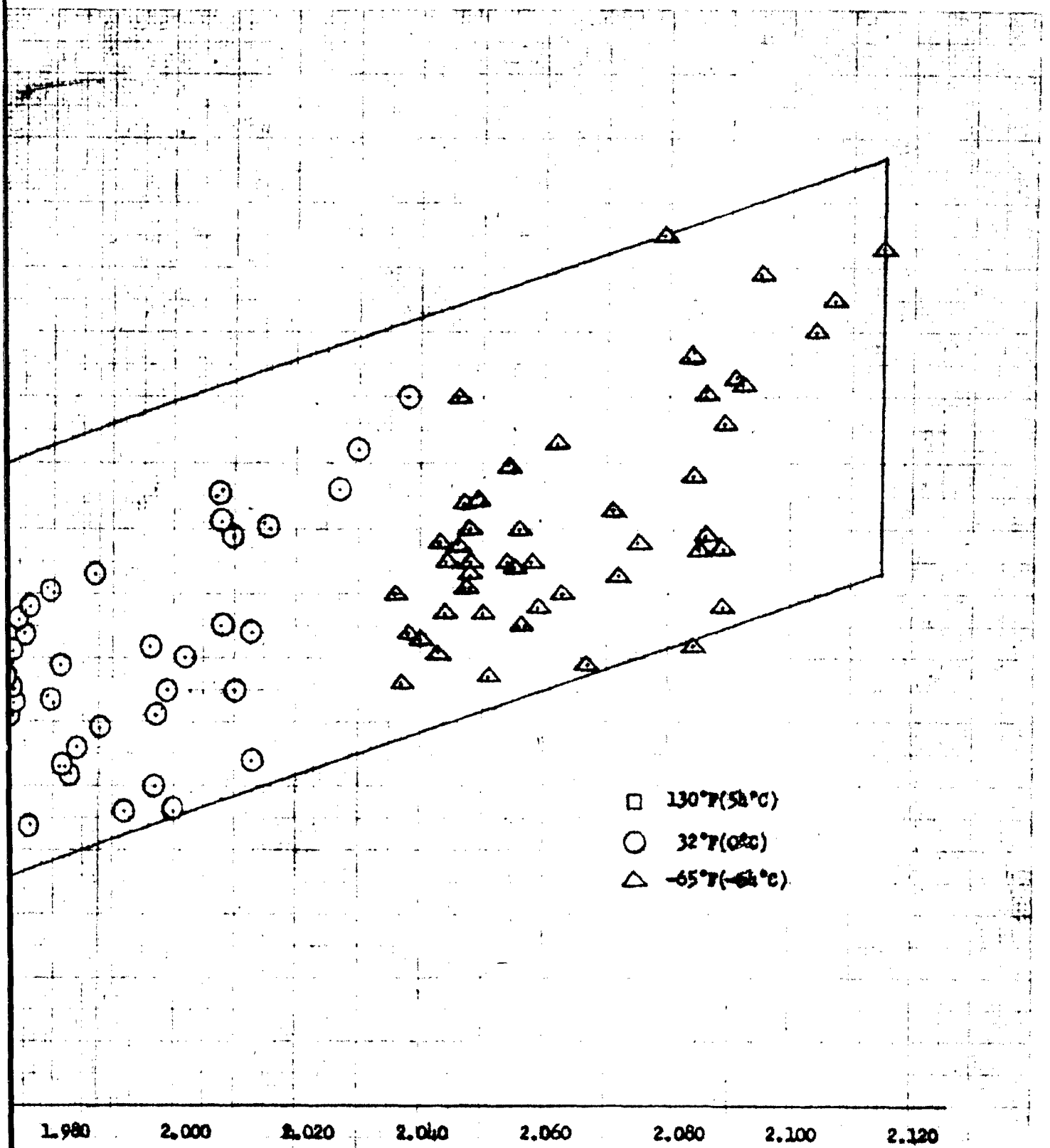
[-54°C),32°F(0°C), and 130°F(54°C), 400 cycles



Dielectric

Figure 5

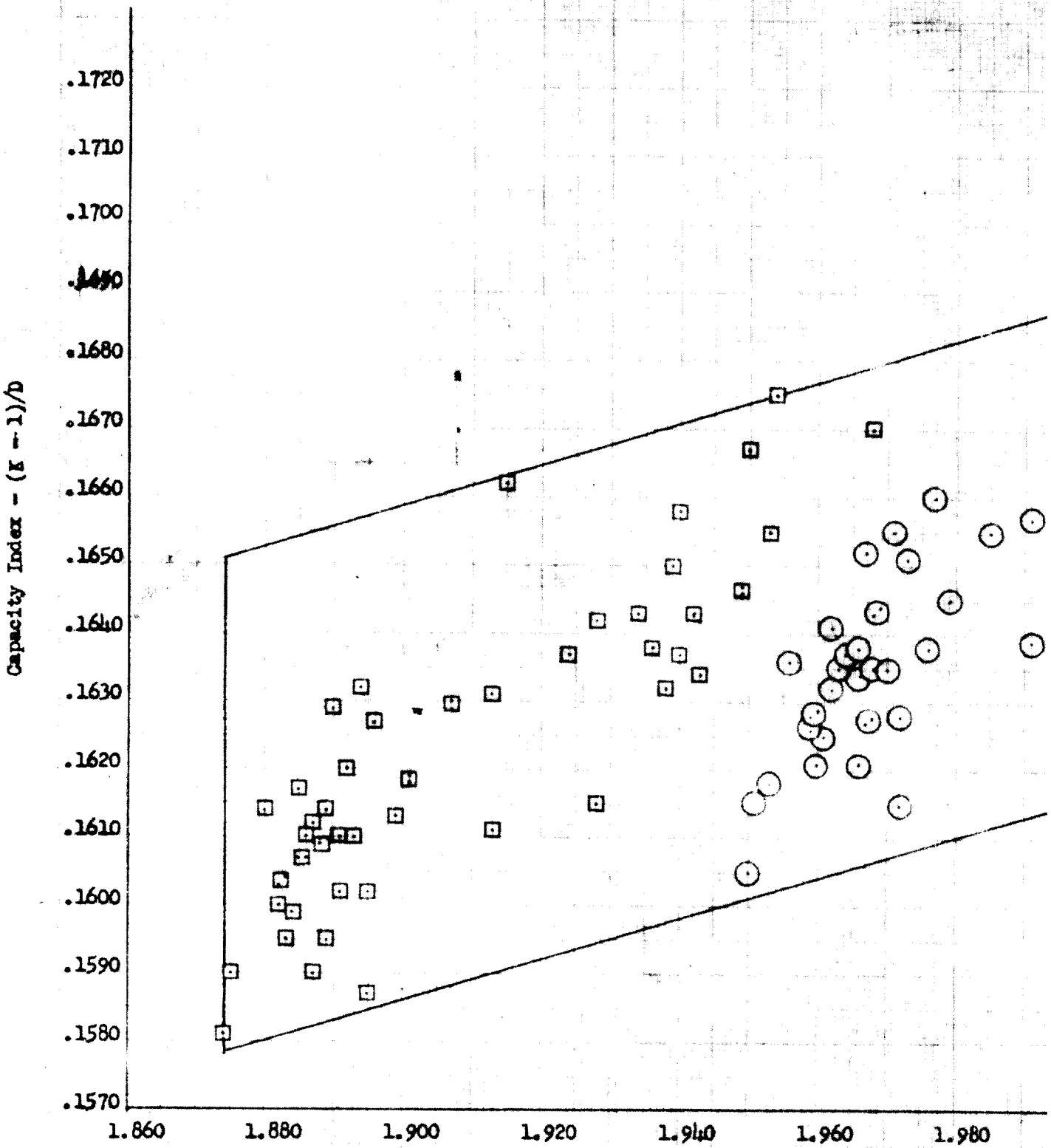
Grade 91/98 Fuel Characteristics at -65°F(-



Dielectric Constant

Figure 52

...istics at -65°F(-54°C), 32°F(0°C), and 130°F(54°C), 400 cycles



Diele

Fi

Grade 100/130 Fuel Characteristics at

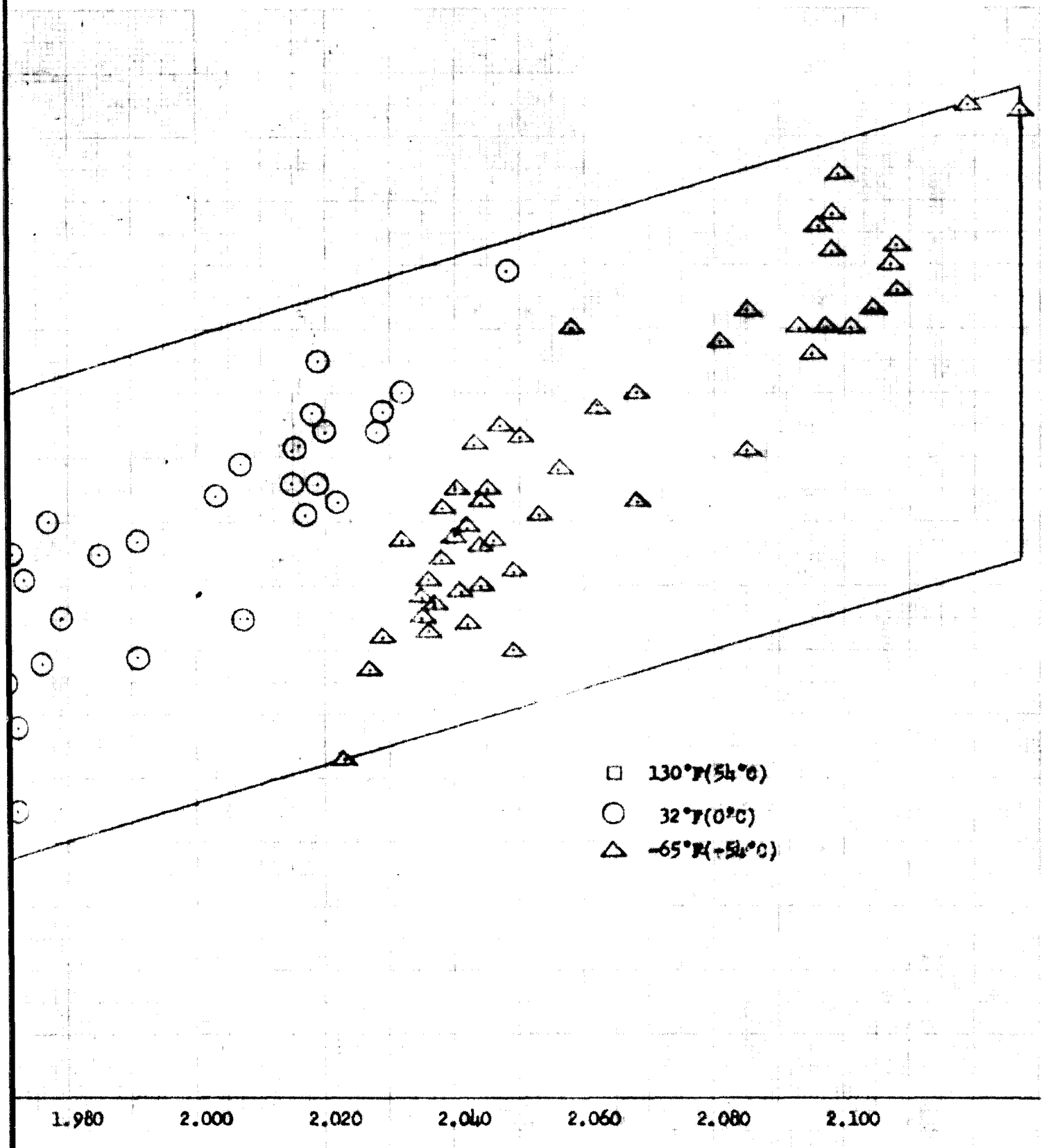
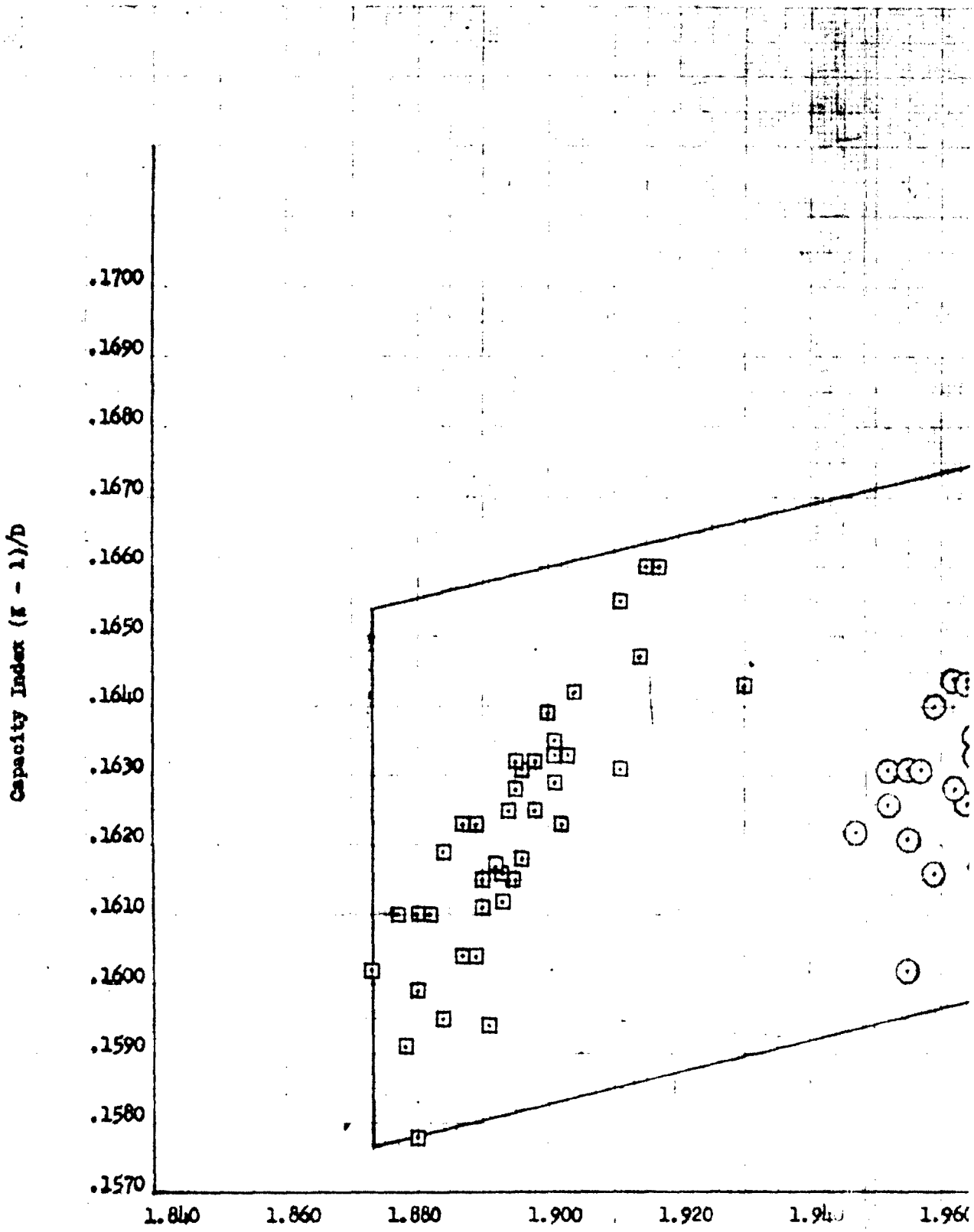


Figure 53

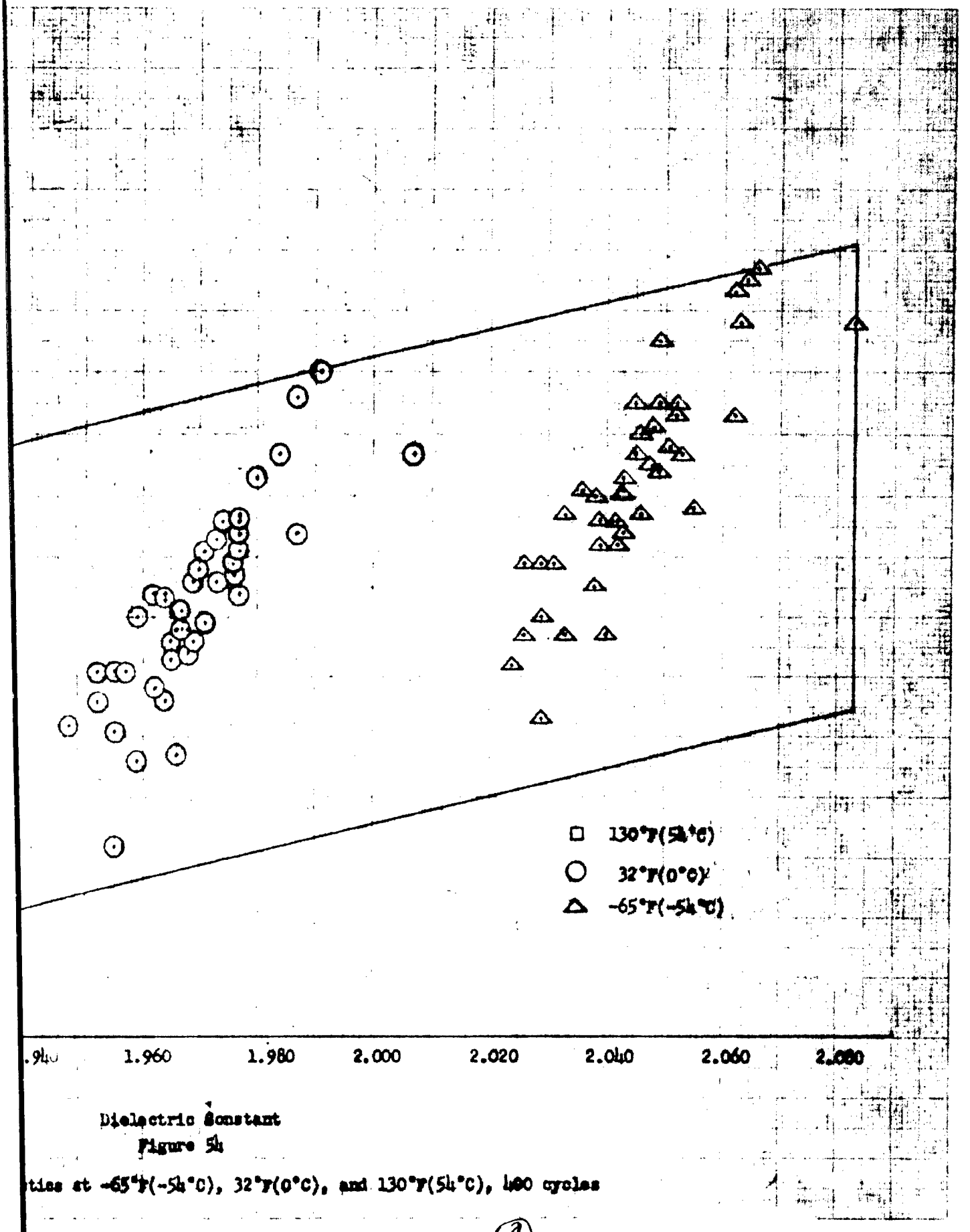
teristics at -65°F(-54°C), 32°F(0°C), and 130°F(54°C), 400 cycles



Dielect

Fig

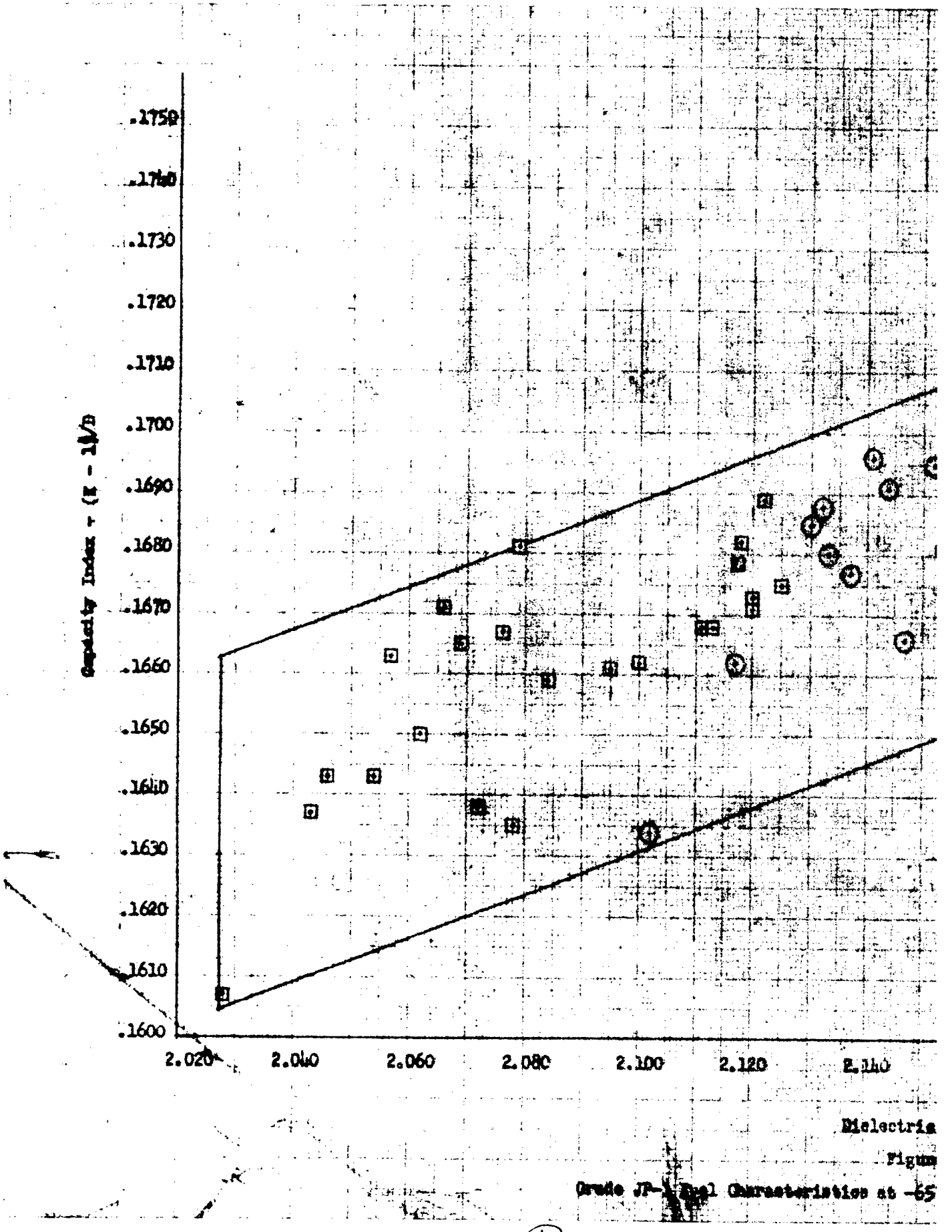
Grade 115/145 Fuel Characteristics at -65°F(-



Dielectric Constant

Figure 54

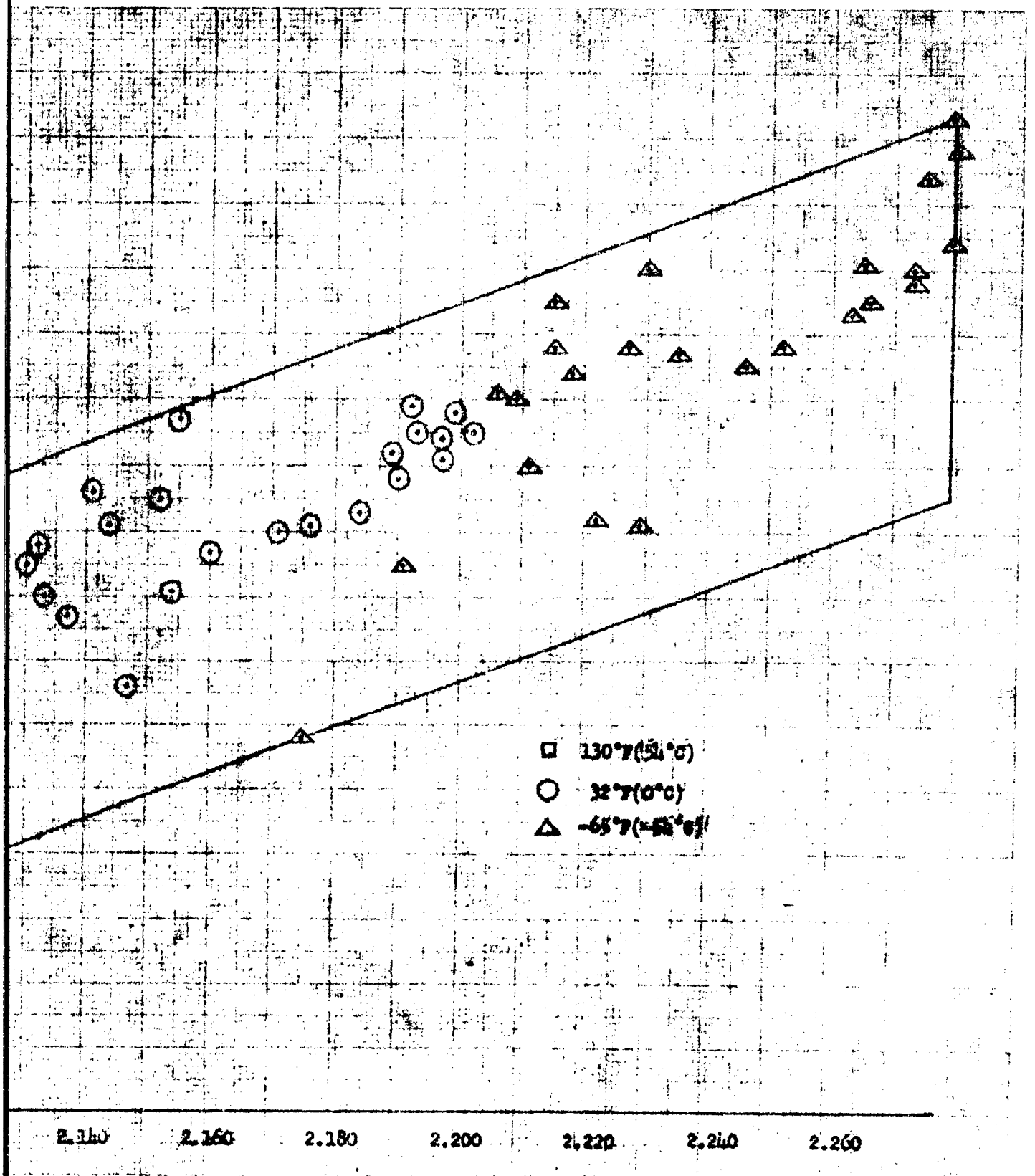
ties at -65°F(-54°C), 32°F(0°C), and 130°F(54°C), 400 cycles



Dielectric

Figure

Crude JP-4 Fuel Characteristics at -65

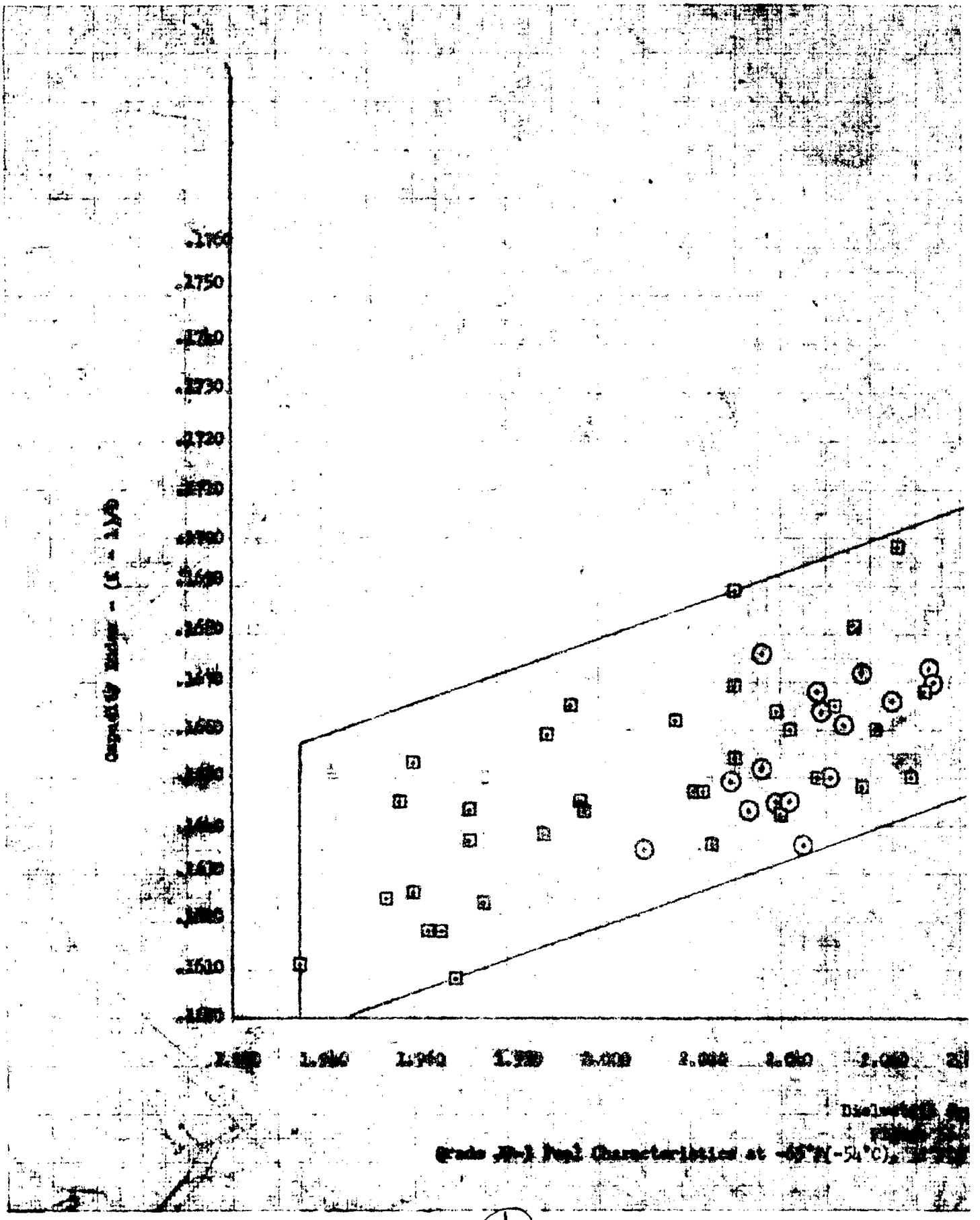


Dielectric Constant

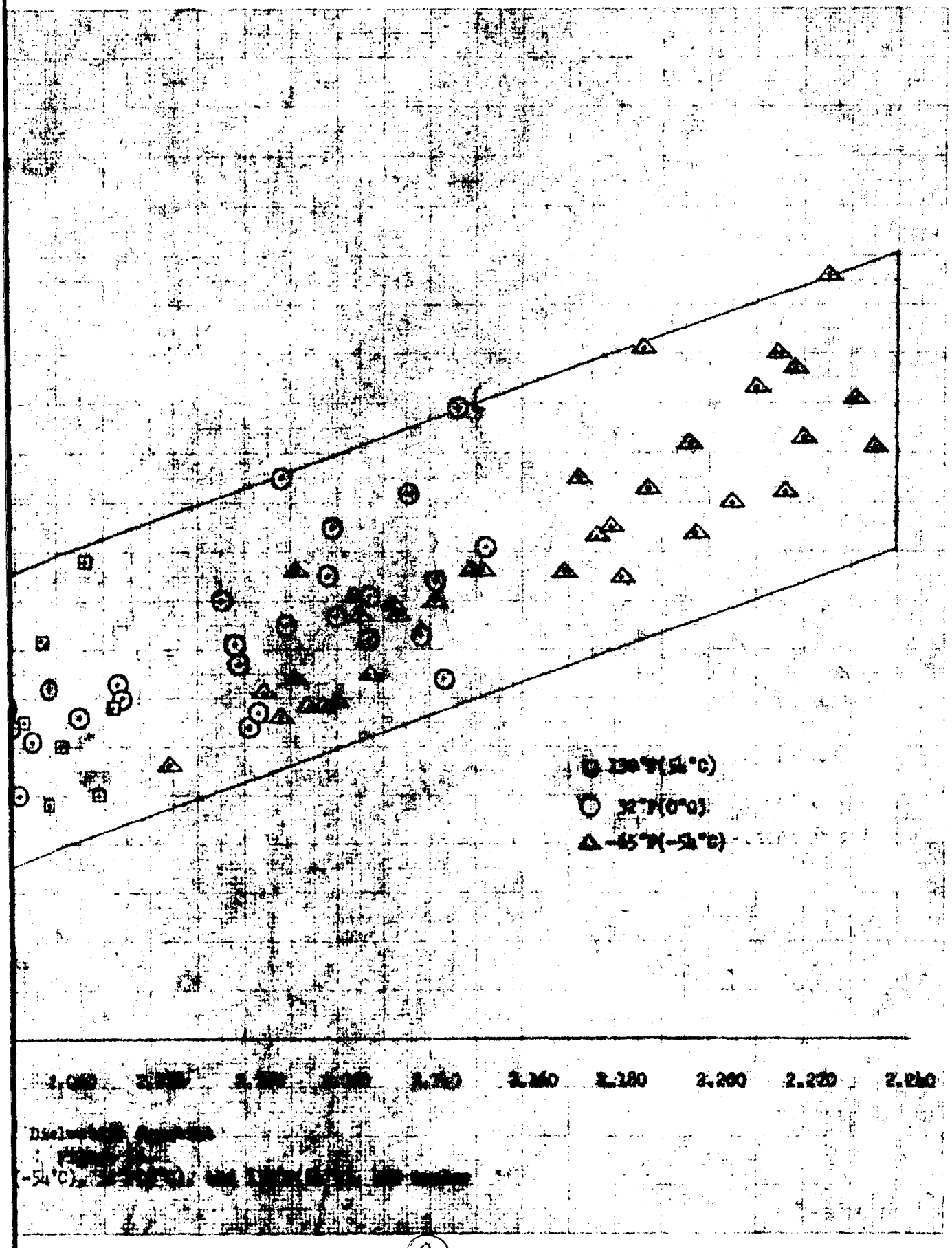
Figure 55

eristics at -65°F(-54°C), 32°F(0°C), and 130°F(54°C), 400 cycles

(2)



Grade JP-4 Fuel Characteristics at -65°F(-54°C)



Dielectric Constant

-54°C),

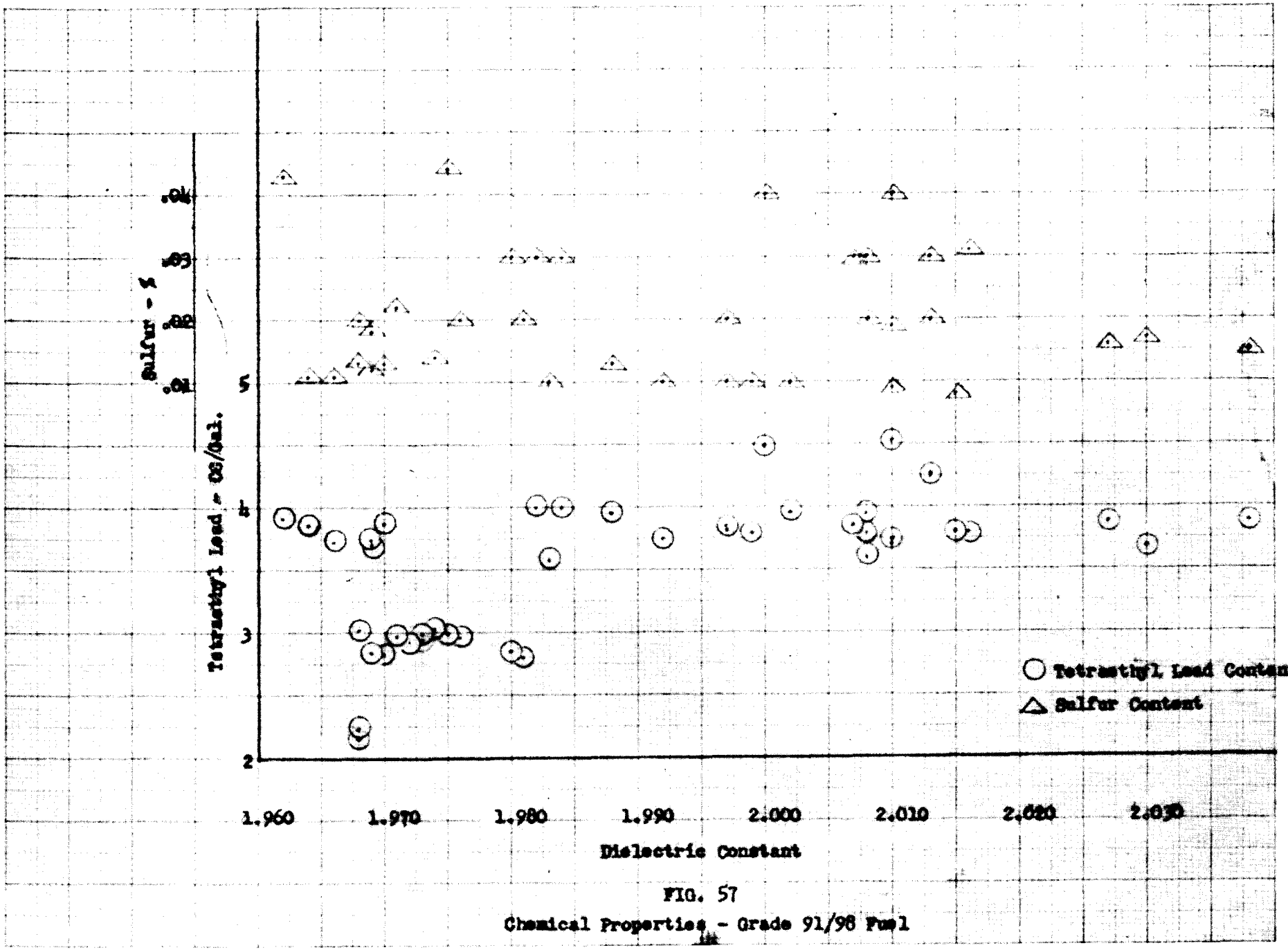


FIG. 57

Chemical Properties - Grade 91/98 Fuel

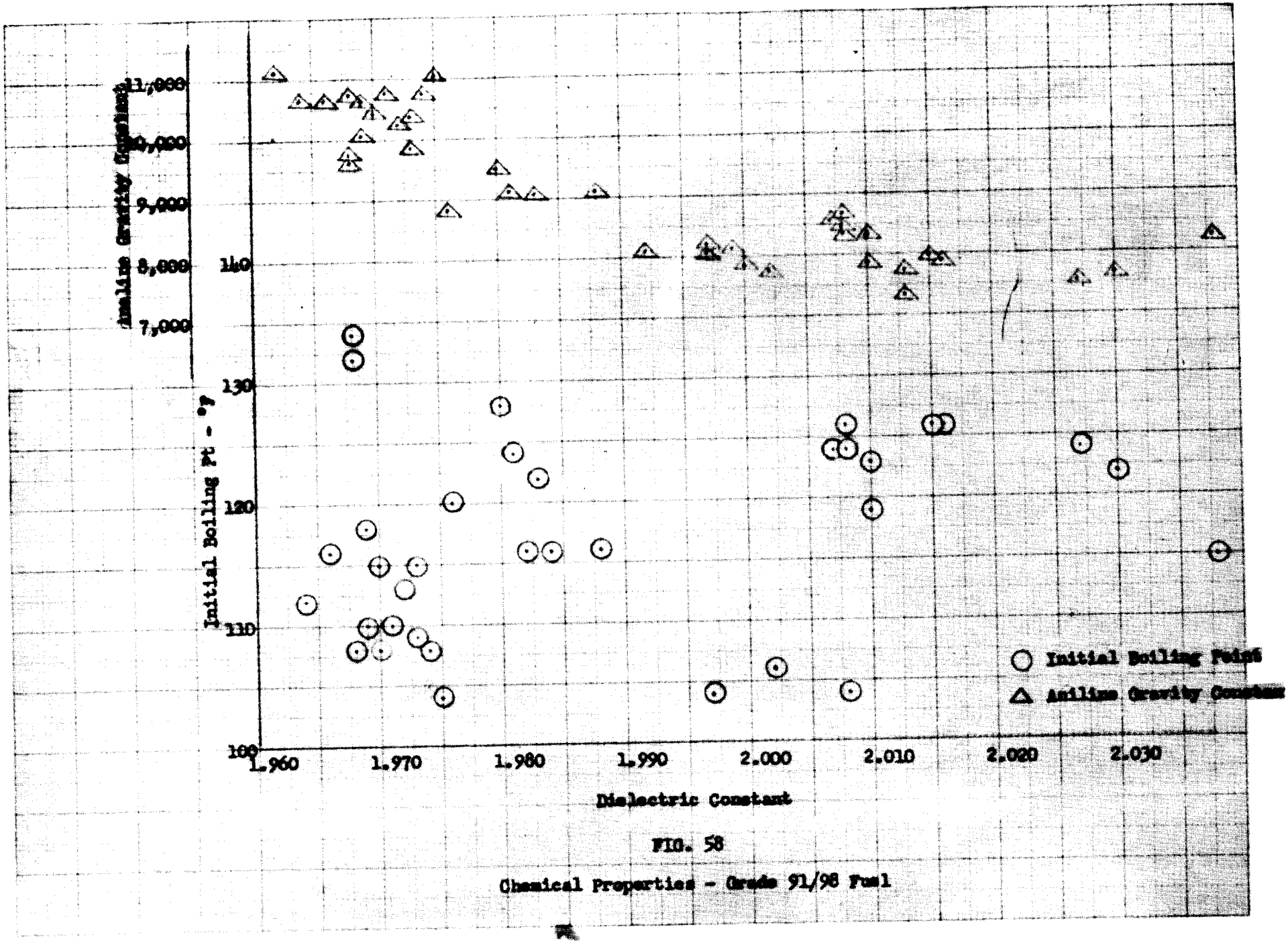
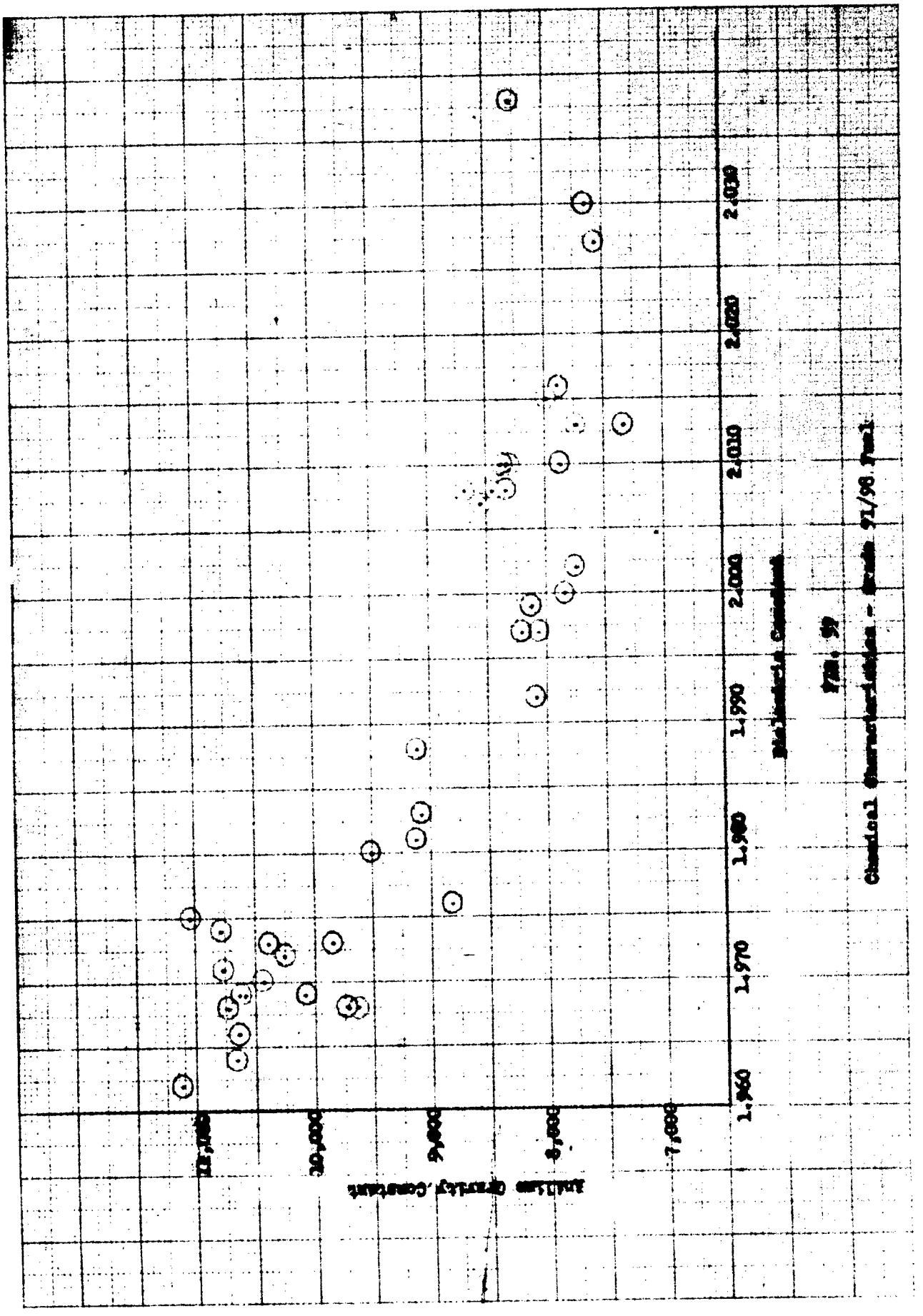


FIG. 58

Chemical Properties - Grade 91/98 Fuel


Chemical Corporation - Grade 91/98 Fuel
Refractive Index
1.960
1.970
1.980
1.990
2.000
2.010
2.020
2.030
Antilog Gravity Constant

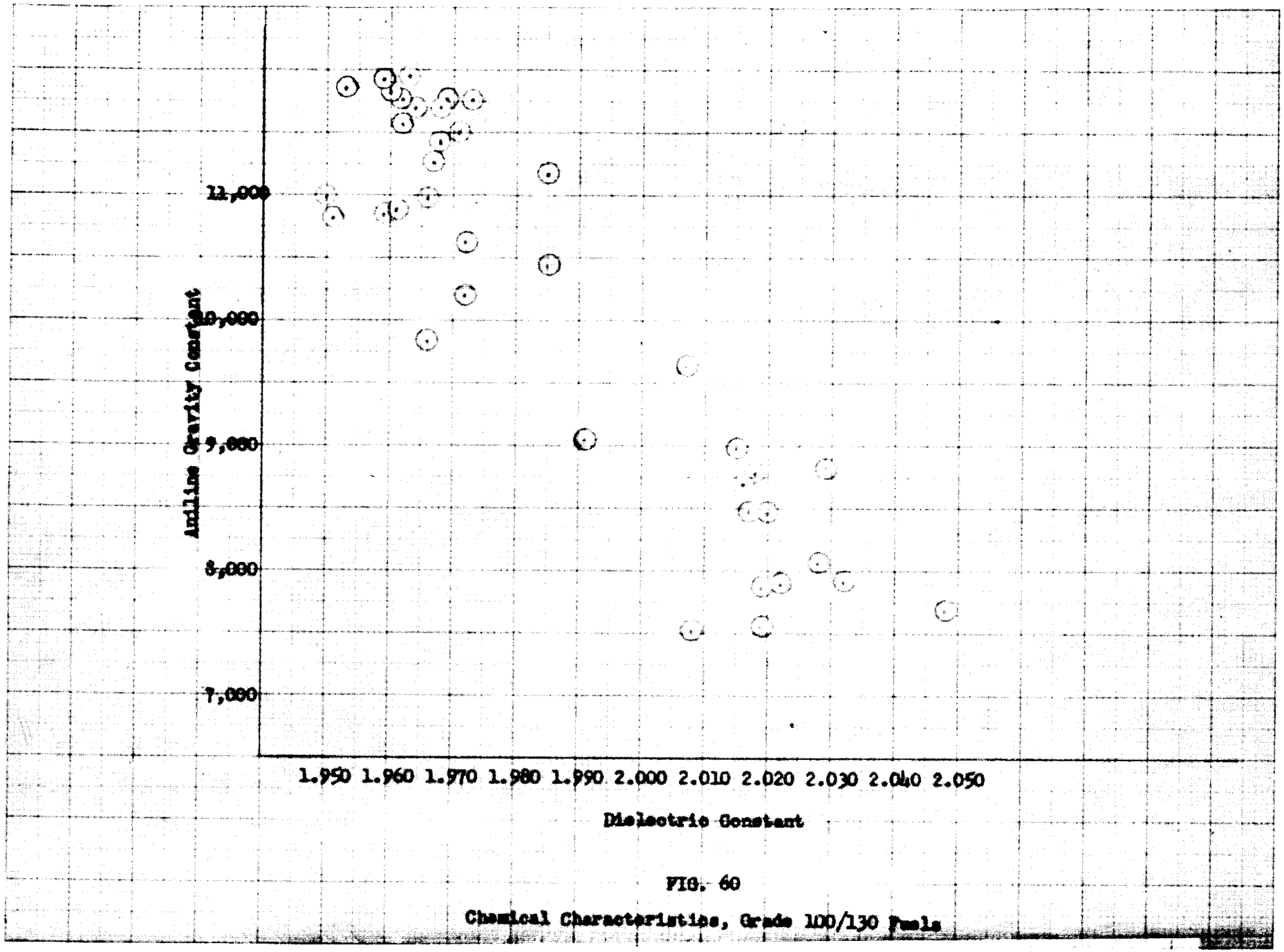


FIG. 60

Chemical Characteristics, Grade 100/130 Fuels

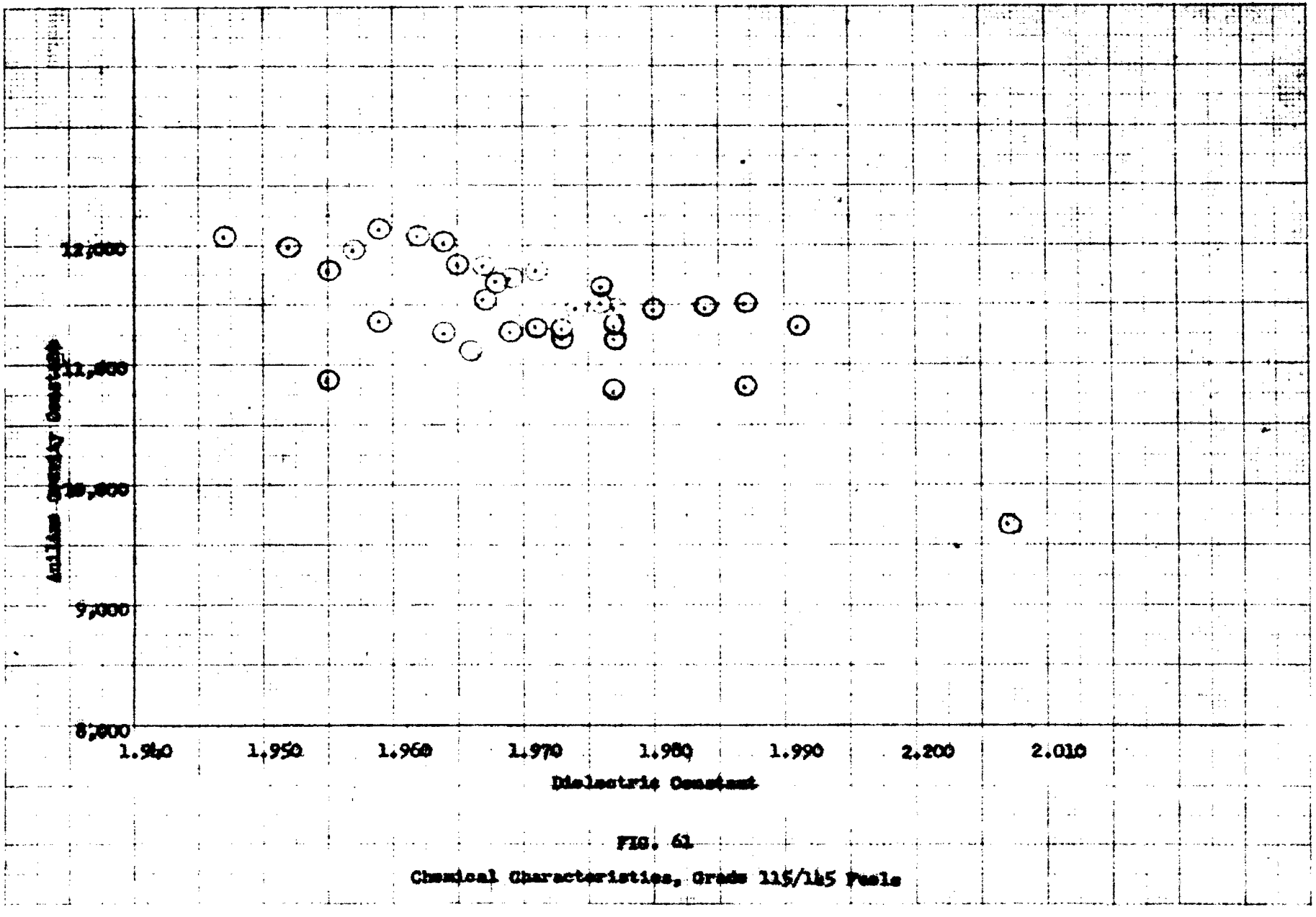


FIG. 61

Chemical Characteristics, Grade 115/145 Fuels

SECTION IV

DISCUSSION

A. Dielectric Constant, Density, and Capacity Index versus Temperature

The effect of temperature variation upon dielectric constant was almost identical for all grades of fuel measured. Considering both unevaporated and evaporated specimens, the maximum variation in the mean slope of the dielectric constant versus temperature curves was only .00004 per degree F for all grades of fuel. In four of the five grades for which the mean slope was calculated, the mean slopes of the evaporated specimens were slightly less than the mean slopes of the unevaporated samples.

Particular curves of dielectric constant versus temperature show apparent variations of slope between successive temperatures, but no significance is attached because these variations correspond in magnitude to the limit of sensitivity of the measuring circuit.

The density of all fuel specimens was practically a linear function of temperature in the region of -65°F (-54°C) to 130°F (54°C).

In general an increase in temperature causes a decrease in capacity index although many exceptions were noted. In the 40 specimens of grade 91/98, 100/130, 115/145, JP-1, and JP-3 fuels tested, the average decrease in capacity index was .0044 as temperature was varied from -65°F (-54°C) to 130°F (54°C). Some of the irregularities in the variation of capacity index may be due to the fact that a small error in dielectric constant causes a relatively large error in capacity index.

B. Dielectric Constant, Density, and Capacity at 32°F (0°C): All Specimens

In Figures 29 to 33, inclusive, specimens were arbitrarily arranged in order of decreasing dielectric constant. The plots of density and capacity index do not decrease progressively with decreases in dielectric constant, but a definite decreasing trend is evident.

Correlations between dielectric constant and density, as shown in Figures 34 to 38 inclusive, are considered to be satisfactory, the highest per unit correlation being .962 for grade JP-3 fuel.

Correlations between capacity index and dielectric constant are also oonsidered to be good although they are not as high as the correlations between dielectric constant and density.

Figure 44 shows that the slopes of all lines of regression of dielectric constant and density are fairly similar while Figure 45 shows a relatively large variation in the slopes of the lines of regression of capacity index and dielectric constant.

The mean values of capacity index for the three grades of reciprocating engine fuels tested agree very closely, the variation being only .48 per cent.

The largest variation of capacity index at 32°F (0°C) among the specimens of any one grade was 5.6% (grades 100/130 and JP-3). The smallest variation was 3.9% in grade 91/98.

The effect of evaporation of 10% by volume on the mean value of capacity index was a maximum increase of .30 per cent in all grades with the exception of JP-1, which showed a .12 per cent decrease. The effects of evaporation on the mean values of dielectric constant and density were found to be increases of .09 to 1.10 per cent in dielectric constant and .25 to 1.82 per cent in density.

C. Dissipation Factor

The specimens having the largest dissipation factors at 400 cps,

as shown in Table 18, were all experimental fuels. However, none of these values is considered high enough to be detrimental to the operation of a capacitance type fuel quantity gage.

D. Slope of Density versus Temperature Curves as a Function of Density

The use of the density equations derived from the line of regression shown in Figure 46 for specimens whose plots are close to line of regression gives extremely accurate results. For the specimens farthest from the line of regression, use of the equations causes errors of not more than .7% at the extremes of temperature.

E. Dielectric Constant, Density, and Capacity Index at -65°F (-54°C), 32°F (0°C), and 130°F (54°C)

The envelopes shown in Figures 47 to 56 were determined by drawing straight lines through the extreme points at each temperature. The edges of these envelopes are in most cases parallel to the line of regression determined at 32°F (0°C).

The extreme points at each temperature usually correspond to the same specimen.

F. Effect of Moisture Content

The effect on dielectric constant of saturating thirteen fuel specimens with distilled water, synthetic hard water, and synthetic sea water was very small as shown in Tables 33,34, and 35. The largest change, .43%, occurred in specimen 378 when saturated with distilled water. In nine of the 39 samples the change in dielectric constant was negative.

The effect of moisture content on dissipation factor at 400 cps and 77°F (25°C) was found to be negligible.

The minor effects of water saturation are not surprising in view of the very small quantities of water which combined with the fuels.

G. Chemical Properties versus Dielectric Constant

Figures 59 to 61 show that as the dielectric constant increases the aniline gravity constant of the reciprocating engine grades of fuel decreases.

Lead, sulfur, and aromatic content and initial boiling point show no correlation with dielectric constant.

H. Evaluation of New Cell

Since the revised cell has practically no change in empty capacitance due to temperature changes, it is extremely well suited for work in which temperature variations are required.

The cell is equally well suited for successive testing of samples without measuring the empty capacitance for each sample. In this case the cell is flushed with an excess portion of the sample to be tested. The relatively large capacitance of the cell gives rise to more accurate measurements.

I. Effect of Storage and Handling

Figure 41 shows that the change in the electrical characteristics of the fuels taken from a B-36 aircraft before and after flight and from the loading truck from which the fuel was originally obtained, is small. It is considered that the change in characteristics due to storage and handling is insignificant. The dissipation factors of all three specimens were below 0.0007 at 77°F (25°C) and 400 cps.